ASSOCIATED RESEARCH, INC.

OPERATION AND SERVICE MANUAL

MODELS 5400DT 5450DT

HYPOT® AND GROUND CONTINUITY TEST SET

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INTRODUCTION

This manual explains the need for dielectric voltage-withstand tests, the precautions necessary to ensure that the tests are done **safely**, and typical application guidelines for testing various classes of materials, components and products.

The manual describes the features of Associated Research Inc. Models **5400DT** and **5450DT** Hypots®, and gives step-by-step instructions for their proper use. Finally, technical data is presented for these models.

Associated Research, Inc. has been manufacturing High Voltage Testing Instruments since 1936. Our line of Dielectric Voltage-Withstand Testers (Hypots®) is the broadest line available today. These products are based upon designs from the early 1940's when ARI manufactured the first commercial Hypot tester for Electric Motor Division of General Motors.

These instruments have gone through several generations of design improvements, building on reliable, field proven technology and contain the features and benefits our customers have requested.

SAFETY PRECAUTIONS REQUIRED FOR HIGH VOLTAGE TESTING

WARNING: A Hipot produces voltages and currents which can cause **harmful or fatal electric shock.** To prevent accidental injury or death, these safety procedures must be strictly observed when handling and using the test instrument.

SERVICE AND MAINTENANCE

User Service
To prevent electric shock do not remove the instrument cover. There are no user serviceable parts inside. Refer servicing to an Associated Research, Inc. authorized service center. Schematics, when provided, are for reference only.

Service Interval
The instrument and its power cord, test leads, and accessories must be returned at least once a year to an Associated Research authorized service center for calibration and inspection of safety related components. Associated Research will not be held liable for injuries suffered if the instrument is not returned for its annual safety check and maintained properly.

User Modifications
Unauthorized user modifications will void your warranty. Associated Research will not be responsible for any injuries sustained due to unauthorized equipment modifications or use of parts not specified by Associated Research. Instruments returned to Associated Research with unsafe modifications will be returned to their original operating condition at your expense.

TEST STATION

Location
Select an area away from the main stream of activity which employees do not walk through in performing their normal duties. If this is not practical because of production line flow, then the area should be roped off and marked for HIGH VOLTAGE TESTING. No employees other than the test operators should be allowed inside.

If benches are placed back-to-back, be especially careful about the use of the bench opposite the test station.

Power
Dielectric Voltage-Withstand Test Equipment must be connected to a good ground. Be certain that the power wiring to the test bench is properly polarized and that the proper low resistance bonding to ground is in place.

Some testers incorporate monitor circuits which check the connections to the power line and ground. The lights on these line

monitors show at a glance if the wiring is correct or if the polarity is wrong, ground missing, etc. If the line monitor shows a fault condition, turn off and unplug the tester and do not use it until the wiring is repaired.

Power to the test station should be arranged so that it can be shut off by one prominently marked switch located at the entrance to the test area. In the event of an emergency, anyone can cut off the power before entering the test area to offer assistance.

Work Area

Perform the tests on a nonconducting table or workbench, if possible. If you cannot avoid using a conductive surface, be certain that it is securely grounded to a good earth ground and insulate the high voltage connection from the grounded surface.

There should not be any metal in the work area between the operator and the location where products being tested will be positioned. Any other metal in the work area should be connected to a good ground, never left "floating".

Position the tester so the operator does not have to reach over the product under test to activate or adjust the tester.

Keep the area clean and uncluttered. All test equipment and test leads not absolutely necessary for the test should be removed from the test bench and put away. It should be clear to both the operator and to any observers which product is being tested, and which ones are waiting to be tested or have already been tested.

Do not perform Hipot tests in a combustible atmosphere or in any area where combustible materials are present.

TEST OPERATOR

Qualifications

This instrument generates voltages and currents which can cause **harmful or fatal electric shock** and must only be operated by a skilled worker trained in its use.

The operator should understand the electrical fundamentals of voltage, current, and resistance. They should recognize that the test instrument is a variable high-voltage power supply with the return lead directly connected to earth ground and therefore, current from the high-voltage output will flow through any available ground path.

Safety Procedures

Operators should be thoroughly trained to follow these and all other applicable safety rules and procedures before they begin a test. Defeating any safety system should be treated as a serious offense and should result in severe penalties, such as removal from the Hipot testing job. Allowing unauthorized personnel in the area during a test should also be dealt with as a serious offense.

Dress

Operators should not wear jewelry which could accidently complete a circuit.

Medical Restrictions

This instrument should not be operated by personnel with heart ailments or devices such as pacemakers.

TEST PROCEDURES

!NEVER PERFORM A HIPOT TEST ON ENERGIZED CIRCUITRY OR EQUIPMENT!

Connect the return (ground) lead **first** for any test regardless of whether the item under test is a sample of insulating material tested with electrodes, a component tested with the high voltage test lead, or a cord-connected device with a two or three prong plug.

Plug in the high voltage test lead only when it is being used. Handle its clip only by the insulator---**never touch the clip directly.**

Be certain that the operator has control over any remote test switches connected to the Hipot.

Before turning on the Hipot, rotate the voltage control to its maximum counterclockwise position. Double check the return (ground) and high voltage connections to be certain that they are proper and secure.

NEVER TOUCH THE ITEM UNDER TEST OR ANYTHING CONNECTED TO IT WHILE HIGH VOLTAGE IS PRESENT DURING THE HIPOT TEST.

At the end of a test, once again rotate the voltage control to its maximum counterclockwise position and check the meter to be sure the voltage across the item under test has dropped to zero before disconnecting the test leads. When testing with DC, always discharge the capacitance of the item under test and anything the high voltage may have contacted--such as test fixtures--before handling it or disconnecting the test leads.

HOT STICK probes can be used to discharge any capacitance in the item under test as a further safety precaution. A hot stick is a nonconducting rod about two feet long with a metal probe at the end which is connected to a wire. To discharge the device under test, two hot sticks are required. First connect both probe wires to a good earth ground. Then touch one probe tip to the same place the return lead was connected. While holding the first probe in place, touch the second probe tip to the same place where the high voltage lead was connected. Again, check the meter to be sure the voltage has dropped to zero.

WHY PERFORM DIELECTRIC VOLTAGE-WITHSTAND TESTS

A dielectric voltage-withstand test is a deliberate application of a higher than normal potential across some insulating material or the entire insulation system of a component or device. This stresses the insulation and the intent is to verify that the insulation can withstand this stress without breaking down (arcing) and without drawing excessive leakage current.

If the insulation passes this test, it is assumed that it will withstand the lesser stress of its intended application. The test can uncover defects in material or workmanship which would render the insulation system ineffective if not corrected and could result in a potentially unsafe product.

The items are most commonly subjected to dielectric voltage-withstand tests fall into four categories:

1. **Insulating raw materials:** solids, liquids, gases.

2. **Components:** switches, relays, transformers, circuit breakers, potentiometers, wire cable, connectors, etc.

3. **End Products:** appliances, motors, instruments, office machines, medical equipment, power tools, etc.

4. **Repaired or rebuilt products:** rewound motors, generators, and transformers; repaired appliances, etc.

The tests performed on these items can usually be grouped into one of the following classes:

1. **Design Tests:** A manufacturer can conduct laboratory tests to check the insulation designed into his product or purchased from an outside supplier. These tests measure the dielectric properties of the material when subjected to the high voltage conditions specified by the manufacturer or supplier. These tests can also gauge the relative insulating quality of competing products during component selection.

2. **Routine Production Tests:** A manufacturer can conduct tests at various points in the production of his products to uncover defects in material or workmanship and take corrective action before the defective product receives further processing. Regulatory agencies or independent testing labs will often require specific tests on completed products immediately prior to packaging for shipment. The products must pass these tests as a condition for "listing" or "recognition" or "certification" or even for permission to offer the product for sale.

3. **Acceptance Tests:** A buyer can conduct tests on purchased components to prove that they meet minimum insulation specifications to prevent faulty components from being incorporated into their products.

4. **Service or Maintenance Tests:** Maintenance personnel responsible for electrical machinery and tools can hipot test their equipment to check the integrity of its insulation system. Periodic testing reveals whether or not deterioration has taken place and its extent.

   Service companies which rebuild motors or fix appliances perform a hipot test after repairing equipment as a safety check to verify that they have done the work properly and have not degraded the product's insulation system.

TYPICAL APPLICATIONS

To insure that the insulation or insulation system is properly stressed during a dielectric voltage-withstand test, the voltage must be applied across the insulation. This is NOT the same connection as is normally used to power up the device being tested.

The voltage used and the time for which it is applied are usually specified by the manufacturer of an insulating material or by a regulatory or testing agency. When they are not, the test is often performed for 60 seconds at twice the normal operating voltage, plus 1000 volts. For example, a household iron rated at 120V would normally be tested at 1240V for one minute.

Application of the test voltage to the items most commonly subjected to a dielectric voltage-withstand test is discussed below:

1. **Insulating raw materials:** The test voltage is applied to the test sample by placing the sample between two metallic electrodes connected to the Hipot output. The size and shape of the electrodes must be proper for the type and amount of material being tested. For testing liquids or gases, suitable containers must also be used. For fixturing information, refer to the individual test specifications for the material to be tested.

2. **Components:** The test voltage is applied between parts which are normally conducting and parts which are normally isolated and nonconducting or grounded. For example, in testing a potentiometer, the three potentiometer terminals would normally be shorted together and connected to the high voltage lead, and the case of the potentiometer would be connected to the return lead. Some components such as motors and transformers require additional tests between two normally conducting parts which must be insulated from each other. For example, a simple transformer would be tested primary to secondary in addition to being tested primary to core and secondary to core.

   When testing transformers, it is a common practice to connect both ends of a winding to the high voltage. It is not the continuity of the winding which is being tested, but the insulation from every part of the winding to other components of the transformer. A similar technique is used to test any winding, coil or heating element in a component, because overstressing these parts is not generally part of the Hipot test.

   Switches and relays are tested from contacts to insulation and across open contacts. A special electrode may be required to

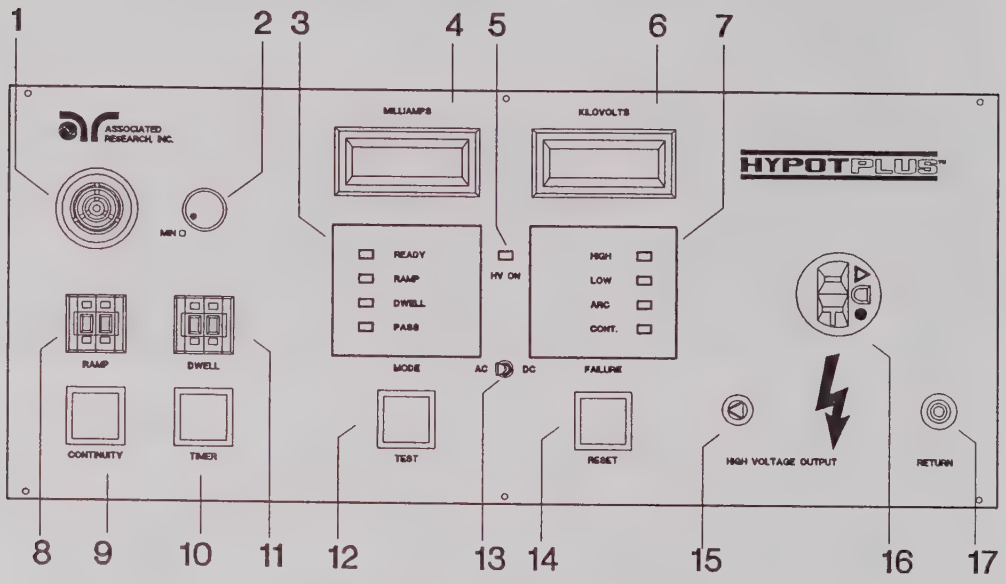
test the insulation of resistors, capacitors and similar items encapsulated by a coating or molded case. The special electrode, touching the outside of the coating or case, is one connection point. The other is the device leads, all shorted together.

3. **End products:** These are typically line-cord connected finished products. The double-insulated variety must be tested with special electrodes touching the outside of the case connected to the return (ground) lead of the Hipot and **BOTH** blades of the line cord connected to the high voltage lead of the Hipot. Any device with metal parts on its exterior should have the return (ground) lead connected to those metal parts (all connected together at once, or sequentially) and the high voltage applied to **BOTH** blades of the line cord.

   When testing cord-connected end products, always leave the power switch on so that the entire line circuit will be tested. If the device does not have a neutral connection, and the ground connection normally carries a current, it will fail a Hipot test from line to ground unless the connection from the internal wiring to ground is temporarily lifted during the test. Combination 115-230V appliances are often of this nature.

4. **Repaired or rebuilt products:** The same techniques are generally used as on new equipment, except that the test voltage or time is sometimes reduced.

FEATURES OF MODELS 5400DT AND 5450DT



FRONT PANEL FEATURES

1. **Alarm** sounds to alert the operator when a failure has occurred. Press the Reset Switch to clear the failure and turn off the alarm.

2. **Voltage Adjust Knob.** This control varies the high voltage output from near zero (MIN position) to the rated output potential (maximum clockwise position).

   To adjust the voltage, the Test switch must be pressed. Therefore, if the setting is unknown, check it on the KV meter with the test leads disconnected or adjust the knob to MIN before pressing the Test switch.

3. The **MODE** indicators display the hipot's operating status as it steps through the test sequence.

3a. **Ready Indicator.** This indicator shows when the hipot is ready to perform the next test. With the Continuity switch in the OFF position, the Ready indicator is normally lit immediately after turning on the Power switch or after pressing the Reset switch. With the Continuity switch in the ON position, the Ready indicator is lit when continuity exists between the chassis ground pin of a three-wire line cord and the exposed

metal on the device under test. The Ready indicator turns off while a test is in process.

3b. **Ramp Indicator.** This indicator is lit when the hipot is in RAMP mode. In this mode, the high voltage output will linearly increase to its preset test level during the interval programmed into the ramp time select switch.

3c. **Dwell Indicator.** This indicator is lit when the hipot is in DWELL mode. In this mode, the hipot maintains the high voltage output at the preset test level for the interval programmed into the dwell time select switch.

3d. **Pass Indicator.** This indicator lights at the end of the hipot test if no failure has occurred during the test.

4. **Digital Milliammeter.** 3½ digits with 1% accuracy, ±1 Least Significant Digit.

5. **High Voltage On Indicator.** This indicator flashes on and off when the Test Switch is pressed to warn the operator that high voltage is present at the high voltage output jack and the high voltage output receptacle.

6. **Digital Kilovolt Meter.** 3½ digits with 1% accuracy, ±1 Least Significant Digit.

7. **Fail Indicators.** When a failure occurs during a hipot test, these indicators tell the operator what kind of failure was detected.

7a. **High Fail Indicator.** This indicator lights when the actual leakage current exceeds the High Current Trip Point.

7b. **Low Fail Indicator.** This indicator lights when the actual leakage current falls below the Low Current Trip Point.

7c. **Arc Fail Indicator.** This indicator lights when an arc breakdown is detected.

7d. **Continuity Fail Indicator.** This indicator lights if the hipot senses greater than 1 ohm resistance between the safety ground pin of a three-wire line cord and exposed metal on the device under test where the return lead is connected.

The Continuity Test Switch must be in the ON position to enable continuity failure detection.

8. **Ramp Time Select Switch.** When a timed test is selected, this switch varies the ramp time from 0 to 99 seconds in 1 second intervals. Pressing the button just below the number increases the time interval. Likewise, pressing the button just above the number decreases the time interval. To insure accurate timing, do not change the switch setting while a test is in process.

9. **Continuity Test On-Off Switch.** This alternate action switch enables continuity testing in the ON position. The switch is ON when the yellow button is pushed in and the lamp is lit.

   When testing devices with a three-wire line cord, this switch should be ON. Continuity testing procedures are explained on page 16.

10. **Timer On-Off Switch.** This alternate action switch selects Timed Testing in the ON position and Manual Testing in the OFF position. The switch is ON when the white button is pushed in and the lamp is lit.

    The Ramp and Dwell Timers are enabled with the switch in the ON position. Manual test procedures are explained on page 17 and Timed test procedures are explained on page 18.

11. **Dwell Time Select Switch.** When a timed test is selected, this switch varies the dwell time from 0 to 99 seconds in 1 second intervals. Pressing the button just below the number increases the time interval. Likewise, pressing the button just above the number decreases the time interval. To insure accurate timing, do not change the switch setting while a test is in process.

12. **Test Switch.** This is a momentary contact switch. Press the green button to turn on the high voltage output. For Manual tests, press and hold the switch. For Timed tests, press and release the switch.

13. **AC/DC Selection Switch** (Model 5450DT only). This is an alternate action switch to select AC or DC testing. The switch setting should not be changed while a test is in process.

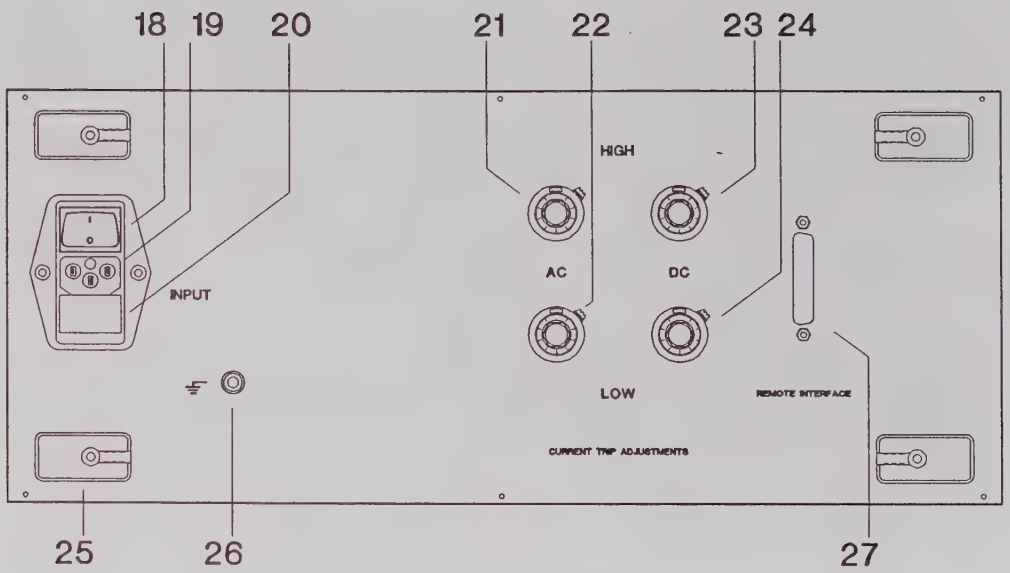
14. **Failure Indicator and Reset Switch.** This is a lamp combined with a momentary contact switch. If excessive ground resistance, out-of-range leakage current, or an arc breakdown is detected during the hipot test, the red Failure lamp will light. To reset the system for the next test, press and release the red Reset button.

    NOTE: Pressing the Reset Switch will terminate any test in process.

15. **Detachable 5 foot (1.52 m) High Voltage Lead** for testing devices without a line cord. The silicone rubber insulation is flexible for easy handling and is rated at 30KVDC. The jack is recessed for safety when this lead is not in use.

16. **Receptacle for Testing Cord-connected Devices.** The line and neutral terminals of this receptacle are **BOTH** connected to the high voltage output. The ground terminal is isolated from ground if the Continuity Test switch is ON, and connected to ground if the Continuity Test switch is OFF.

17. **Detachable 5 foot (1.52 m) Return (ground) Lead.** This lead is always used in making a test. It is grounded for safety during the test. When testing a device with a three-wire cord, continuity is measured between the device's chassis ground pin and the return lead.



REAR PANEL FEATURES

18. **Power Switch.** Rocker-style switch with international ON (1) and OFF (0) markings.

19. **Standard IEC 320 connector** with detachable 7½ foot (2.29 m) power cord.

20. **Line fuse and voltage changer** integrated with power connector. To change the fuse unplug power cord and insert a screwdriver into the slot to slide open fuse the compartment.

    Line voltage selection is set by the position of the fuse compartment. For 110-120V operation align the 110V arrow on the fuse compartment with the arrow on the body of the power module and slide it into place.

    For 220-240V operation align the 220V arrow on the fuse compartment with the arrow on the body of the power module and slide it into place.

21. **AC High Current Trip Adjustment.** This control sets the AC HIGH trip point from .25 to 20 mA. If the leakage current of the device under test exceeds this setting, the HIGH FAIL alarm will trip. Turn the control counterclockwise to lower the trip point and clockwise to raise the trip point.

22. **AC Low Current Trip Adjustment.** This control sets the AC LOW trip point from .1 to 10 mA. If the leakage current of the device under test is less than this setting, the LOW FAIL alarm will trip. Turn the control counterclockwise to lower the trip point and clockwise to raise the trip point.

23. **DC High Current Trip Adjustment** (Model 5450DT only). This control sets the DC HIGH trip point from .25 to 5 mA. If the leakage current of the device under test exceeds this setting, the HIGH FAIL alarm will trip. Turn the control counterclockwise to lower the trip point and clockwise to raise the trip point.

24. **DC Low Current Trip Adjustment** (Model 5450DT only). This control sets the DC LOW trip point from .1 to 5 mA. If the leakage current of the device under test is less than this setting, the LOW FAIL alarm will trip. Turn the control counterclockwise to lower the trip point and clockwise to raise the trip point.

25. **Cord Wrap** for line cord storage. Plug inserts into center slot.

26. **Chassis Ground Terminal** will accept banana plug, spade lug, or stripped wire connection. This terminal should be connected to a good earth ground before using the test instrument.

27. The **Remote Interface** provides a convenient way to connect the hipot to an automatic test system. The interface connector is an industry standard 25-pin "D" subminiature female receptacle. See page 22 for a complete description of the remote interface connector signals and guidelines for connection to an automatic test system.

PERFORMING CONTINUITY TESTS

Continuity testing is done to insure that a low resistance path exists between the safety ground pin of a three-wire line cord and exposed metal of the item under test.

If a live wire inside the item under test came loose and contacted the chassis, the fault current would flow through the low resistance safety ground, protecting the user.

When testing equipment with three-wire line cords follow the steps below:

1. Set the Continuity Switch to the ON position with the yellow lens lit.

2. Connect the return lead from the tester to exposed metal on the chassis of the item under test.

3. Plug the three-wire line cord into the high voltage receptacle.

4. If continuity is GOOD (1 ohm or less), the Ready indicator will light. Proceed with the hipot test by pressing the Test Switch.

   Continuity is continuously monitored during the hipot test. If continuity is lost while the test is in process, the high voltage will shut off, the Continuity Fail and Red Failure Indicators will light, and the audio alarm will sound. Press the Reset Switch to clear the failure and reset the system for the next test.

5. If continuity is BAD (greater than 1 ohm), the Ready indicator will not light. Pressing the Test Switch will not apply high voltage, the Continuity Fail and Red Failure Indicators will light, and the audio alarm will sound. Press the Reset Switch to clear the failure and reset the system for the next test.

PERFORMING MANUALLY OPERATED TESTS

CAUTION: To insure operator safety, review and follow the Safety Precautions for High Voltage Testing at the beginning of this manual before performing any high voltage tests.

1. Locate the Hypot® in an isolated area where adequate light and power are available. Allow enough room around the device to be tested to make straightforward and uncrowded connections and to insure that all personnel will be able to stay clear during the tests.

   The table or bench should be nonconducting. If a conductive surface must be used, it should be securely grounded to a good earth ground, and the high voltage connection must be insulated from ground.

2. Be sure the power switch is **OFF**. Install and connect the line cord and turn the Power switch ON.

3. Connect the return lead to the Hypot® and to the item to beawested. If testing with the high voltage lead, connect it to the Hypot® and to the item under test. If testing a cord-connected item, plug it into the high voltage receptacle and set the Continuity Test switch to ON for a three-wire line cord or OFF for a two-wire line cord or other device.

4. Place the Timer Switch into the OFF position. Rotate the voltage control fully counterclockwise. Press and hold the Test switch and rotate the voltage control clockwise while observing the output voltage on the KV meter. When the meter reads the desired test voltage, start timing the test. Hold the switch for the duration of the test interval and then release the switch.

   NEVER TOUCH THE ITEM UNDER TEST OR ANYTHING CONNECTED TO IT WHILE HIGH VOLTAGE IS PRESENT DURING THE HIPOT TEST.

   If no failure occurs during the test interval, the item has passed the hipot test. If excessive ground resistance, out-of-range leakage current, or an arc breakdown is detected during the hipot test, the high voltage will shut off, the Failure indicators will light and the audio alarm will sound. To reset the system for the next test, press and release the Reset switch.

5. Verify that high voltage has dropped to zero by observing the kilovolt meter. The item tested can then be disconnected and the next item connected for testing.

PERFORMING TIMED TESTS

CAUTION: To insure operator safety, review and follow the Safety Precautions for High Voltage Testing at the beginning of this manual before performing any high voltage tests.

1. Locate the Hypot® in an isolated area where adequate light and power are available. Allow enough room around the device to be tested to make straightforward and uncrowded connections and to insure that all personnel will be able to stay clear during the tests.

   The table or bench should be nonconducting. If a conductive surface must be used, it should be securely grounded to a good earth ground, and the high voltage connection must be insulated from ground.

2. Be sure the power switch is **OFF**. Install and connect the line cord and turn the Power switch ON.

3. Connect the return lead to the Hypot® and to the item to be tested. If testing with the high voltage lead, connect it to the Hypot® and to the item under test. If testing a cord-connected item, plug it into the high voltage receptacle and set the Continuity Test switch to ON for a three-wire line cord or OFF for a two-wire line cord or other device.

4. Place the Timer Switch into the OFF position. Rotate the voltage control fully counterclockwise. Press and hold the Test switch and rotate the voltage control clockwise while observing the output voltage on the KV meter. When the meter reads the desired test voltage, release the switch.

   NEVER TOUCH THE ITEM UNDER TEST OR ANYTHING CONNECTED TO IT WHILE HIGH VOLTAGE IS PRESENT DURING THE HIPOT TEST.

   If the test voltage can be applied all at once, then the Ramp timer should be set to 00. If the voltage must be applied gradually, the Ramp Timer should be set for the desired ramp up interval.

5. Place the Timer Switch in the ON position. Set the test interval with the Ramp Time and Dwell Time Select Switches.

6. Press and release the Test switch. During the Ramp time, the high voltage will uniformly increase to the level set in Step 4 and remain at this level for the duration of the Dwell Time.

   If no failure occurs during the test interval, the item has passed the hipot test. If excessive ground resistance, out-

of-range leakage current, or an arc breakdown is detected during the hipot test, the high voltage will shut off, the Failure indicators will illuminate and the audio alarm will sound. To reset the system for the next test, press and release the Reset switch.

7. Verify that high voltage has dropped to zero by observing the kilovolt meter. The item tested can then be disconnected and the next item connected for testing.

CURRENT TRIP POINT ADJUSTMENTS

The HIGH CURRENT trip point sets the upper limit for the actual leakage current of the Device Under Test (DUT). Likewise, the LOW CURRENT trip point sets the lower limit for the DUT leakage current.

If the actual leakage current from the DUT is between these limits, the DUT passes the hipot test. If the DUT leakage current is outside these limits, the high voltage will shut off, the fail indicator will light and the alarm will sound.

If the actual leakage current exceeds the high current trip point the HIGH FAIL indicator will light; likewise, if the actual leakage current is less than the low current trip point the LOW FAIL indicator will light.

The high and low current trip points are preset to 5 ma and .5 ma respectively. If these settings are not appropriate for your application, they can be reset as follows.

Preliminary Settings

When setting the high and low trip points for the first time, disengage the shaft locks, rotate the High Trip Point control to its maximum clockwise (CW) position, and rotate the Low Trip Point control to its maximum counterclockwise (CCW) position.

Connect a test load across the high voltage output and return leads. The test load should be a value in the 120K to 2M impedance range which approximates the load of the DUT.

Rotate the voltage control to its maximum counterclockwise position (minimum output).

Set the Dwell Timer for 99 seconds and place the timer select switch in the ON position.

High Trip Point Adjustment

Push and release Test Switch and raise the voltage until the current as shown on the milliammeter reaches the desired high limit value.

Rotate the High Trip Point control counterclockwise until the High Fail alarm trips.

To clear the failure, press and release the Reset Switch.

To verify the setting, rotate the voltage control counterclockwise to slightly reduce the voltage. Push and release the test switch

and slowly raise the voltage while monitoring the current. When the current just reaches the set point, the High Fail alarm should trip.

If the alarm trips with the current too low or too high, adjust the High Trip Point control slightly CW or CCW and reverify the setting.

When the adjustment is set, engage the shaft lock to hold the setting in place.

Low Trip Point Adjustment

Push and release Test Switch and raise the voltage until the current as shown on the milliammeter reaches the desired low limit value.

Rotate the Low Trip Point control CW until the Low Fail alarm trips.

To clear the failure, press and release the Reset Switch.

To verify the setting, rotate the voltage control CW to slightly increase the voltage. Push and release the test switch and slowly lower the voltage while monitoring the current. When the current just reaches the set point, the Low Fail alarm should trip.

If the alarm trips with the current too low or too high, adjust the Low Trip Point control slightly CW or CCW and reverify the setting.

When the adjustment is set, engage the shaft lock to hold the setting in place.

Turn off the Dwell Timer and restore the Dwell Time to its original setting.

REMOTE INTERFACE

The remote interface provides the user with a convenient way to connect the hipot to a wide variety of test equipment ranging from a simple footswitch for hands-free test initiation to a complex computer-based automatic test system for statistical process control.

Through the remote interface, the test system can start and stop the hipot test, set the voltage applied to the item under test, measure the actual test voltage and leakage current during the test, and monitor fault conditions which may occur while the test is in process.

Each of the interface functions is described below, followed by a table showing the signals assigned to each contact of the interface connector.

Input Switches

Three user-provided switches can be connected to the hipot. Either a dry-closure relay contact or an optically-isolated open collector transistor can be used. The transistor must be capable of sinking 1 ma at .2VDC with 5VDC collector-emitter breakdown.

TEST SWITCH: Closing the Test switch initiates a test. If the hipot is set to manual mode the test will continue until a failure is detected or the switch is opened, whichever occurs first.

If the hipot is set to timed mode, the test will continue until a failure is detected or the ramp and dwell cycle times expire, whichever occurs first. If the Test switch stays closed at the end of a timed test, the next test cannot begin until the Test switch is first opened.

The Timer switch on the front panel is in the OFF position for manual mode or in the ON position for timed mode.

RESET SWITCH: Closing the Reset switch terminates any test in process and turns off the failure alarm, front panel failure indicators, and remote failure relays. The hipot remains in the reset state until the Reset switch is released.

SELECT SWITCH: Closing the Select switch disables the voltage control on the front panel and enables the test voltage to be set from an external DC voltage source connected to the Remote Set inputs.

Output Relays

Six relays monitor and report the results of the hipot test. The relays have normally open contacts rated for 24VDC, .25A RESISTIVE loads such as logic gates, optoisolators, and solid-state relays. Do not use the remote relays to switch inductive loads such as relay coils which can damage the contacts.

TEST IN PROCESS: The Test in Process relay closes at the start of a test, remains closed during the entire test cycle, and opens when the test cycle ends. The Test in Process relay closes 25 msec. before the high voltage output is energized.

PASS: The Pass relay closes if the item under test passes the hipot test. The relay remains closed until another test is started with the Test switch or until the Reset switch is closed.

HIGH FAIL: The High Fail relay closes if the actual leakage current exceeds the High Current Trip Point during the hipot test. The relay stays closed until the Reset switch is closed.

LOW FAIL: The Low Fail relay closes if the actual leakage current falls below the Low Current Trip Point during the hipot test. The relay stays closed until the Reset switch is closed.

ARC FAIL: The Arc Fail relay closes if a flashover or breakdown is detected during the hipot test. The relay stays closed until the Reset switch is closed.

CONTINUITY FAIL: The Continuity Fail relay closes if the hipot senses greater that 1 ohm resistance between the safety ground pin of a three-wire line cord and exposed metal on the item under test where the return lead is connected. The relay stays closed until the Reset switch is closed.

The Continuity switch on the front panel must be in the ON position to enable continuity failure detection.

Remote Voltage Set

When the Select switch is closed, the high voltage output is controlled by the voltage applied to the Remote Voltage Set inputs. A 0 to 10VDC input voltage will set the high voltage output from near zero to its maximum output level.

Remote Meter Outputs

The remote meter outputs generate a DC voltage proportional to the actual test voltage and leakage current present at the item under test. These outputs are useful for monitoring actual test conditions in a computer-controlled test system. These outputs are floating relative to the hipot chassis. The input resistance of the measuring device (multimeter, analog-to-digital converter, etc) should be at least 100K.

KILOVOLT METER: These outputs generate a DC voltage proportional to the high voltage output. The scale factor is .50 VDC = 1 KV with a maximum output of 10 VDC = 20 KV.

MILLIAMP METER: These outputs generate a DC voltage proportional to the leakage current. The scale factor is .50 VDC = 1 mA. with a maximum output of 10 VDC = 20 mA.

Interface Connector

The interface connector is an industry standard 25-pin "D" subminiature female connector. The signal assigned to each contact of the interface connector is shown in table below:

#	FUNCTION	DESCRIPTION
1	Test Switch +	Switch input, signal
14	Test Switch -	Switch input, reference
2	Reset Switch +	Switch input, signal
15	Reset Switch -	Switch input, reference
3	Test in Process C	Relay output, common
16	Test in Process NO	Relay output, normally open
4	Pass C	Relay output, common
17	Pass NO	Relay output, normally open
5	High Fail C	Relay output, common
18	High Fail NO	Relay output, normally open
6	Low Fail C	Relay output, common
19	Low Fail NO	Relay output, normally open
7	Arc Fail C	Relay output, common
20	Arc Fail NO	Relay output, normally open
8	Continuity Fail C	Relay output, common
21	Continuity Fail NO	Relay output, normally open
9	Select Switch +	Switch input, signal
22	Select Switch -	Switch input, reference
10	Remote Voltage Set +	Input voltage, positive
23	Remote Voltage Set -	Input voltage, negative
11	Kilovolt Meter +	Output voltage, positive
24	Kilovolt Meter -	Output voltage, negative
12	Milliamp Meter +	Output voltage, positive
25	Milliamp Meter -	Output voltage, negative
13	No connection	

Mating Connector:
The interface connector mates with a 25-pin "D" subminiature male connector provided by the user. For maximum noise immunity the mating connector should have a metallic shell and cable clamp. Suggested AMP part numbers are shown below; equivalent parts may be substituted.

207464-2	PLUG SHELL WITH GROUND INDENTS
755254-7	CRIMP SNAP-IN PIN CONTACT
745173-1	SHIELDED CABLE CLAMP
747784-3	JACKSCREWS (SET OF 2)

Interface Cable:
For maximum noise immunity, use #24AWG twisted pair cable with an overall foil shield and drain wire to interconnect the hipot remote interface and the remote controller. **TO AVOID GROUND LOOPS, THE SHIELD SHOULD NOT BE CONNECTED TO GROUND AT BOTH ENDS OF THE CABLE.** The preferred place to ground the cable shield is at the remote controller. If this is not possible, then ground the shield to the connector shell at the hipot. The maximum length for the interface cable is 100 feet.

The suggested 25-conductor interface cable is shown below; equivalent cable may be substituted.

CABLE TYPE:	BELDEN 9684
TWISTED PAIRS:	12½
WIRE GAGE:	24AWG
CHARACTERISTIC IMPEDANCE:	100 OHMS
NOMINAL DC RESISTANCE:	24 OHMS/1000 FT
NOMINAL CAPACITANCE:	15.5 PF/FT
NOMINAL O.D.:	.508 IN

SPECIFICATIONS

MODEL	5400DT
DESCRIPTION	AC Hypot® and Ground Continuity Test Set
PRIMARY APPLICATION	Manufacturing and production line testing of commercial and consumer products to meet UL, CSA, and other safety agency requirements where dielectric voltage-withstand and ground continuity tests are specified.
INPUT	115VAC, 50/60Hz, Single phase, 1.6A Max. 230VAC, 50/60Hz, Single phase, 1.0A Max. User selectable.
FUSE	1.6A 250V SLO BLO 5 x 20 mm (Buss GDC-1.6A)
OUTPUT VOLTAGE	0-5KVAC, Continuously adjustable. Zero-crossing turn-on. No transients exceeding 105% of peak value. 1% regulation over line input range and 120K to 2M load.
OUTPUT CURRENT	0-20mA
HIGH TRIP CURRENT RANGE	.25-20mA adjustable with multiturn pot. Factory set to 5ma.
LOW TRIP CURRENT RANGE	.1-10mA adjustable with multiturn pot. Factory set to 0.0ma.
CONTINUITY TRIP	1 ohm maximum at .1A.
FAILURE DETECTOR	Audible and visual
RAMP TIMER	0-99 Seconds in 1 second increments
DWELL TIMER	0-99 Seconds in 1 second increments
KILOVOLT METER	0-19.99 digital. 1% accuracy ±1 Least Significant Digit.
MILLIAMP METER	0-19.99 digital. 1% accuracy ±1 Least Significant Digit.
SIZE (W X H X D)	17 X 7.5 X 14.5 inches.
WEIGHT	23 pounds.

SPECIFICATIONS

MODEL	5450DT
DESCRIPTION	AC/DC Hypot® and Ground Continuity Test Set
PRIMARY APPLICATION	Manufacturing and production line testing of commercial and consumer products to meet UL, CSA, and other safety agency requirements where dielectric voltage-withstand and ground continuity tests are specified.
INPUT	115VAC, 50/60Hz, Single phase, 1.6A Max. 230VAC, 50/60Hz, Single phase, 1.0A Max. User selectable.
FUSE	1.6A 250V SLO BLO 5 x 20 mm (Buss GDC-1.6A)
OUTPUT VOLTAGE	0-5KVAC, 0-5KVDC continuously adjustable. Zero-crossing turn-on. No transients exceeding 105% of peak value. 1% regulation over line input range and 120K to 2M load.
OUTPUT CURRENT	0-20mA AC, 0-5mA DC
HIGH TRIP CURRENT RANGE	.25-20mA AC, .25-5mA DC adjustable with multi-turn pot. Factory set to 5ma AC, 1mA DC.
LOW TRIP CURRENT RANGE	.1-10mA AC, .1-5mA DC adjustable with multi-turn pot. Factory set to 0.0ma AC and DC.
CONTINUITY TRIP	1 ohm maximum at .1A.
FAILURE DETECTOR	Audible and visual
RAMP TIMER	0-99 Seconds in 1 second increments
DWELL TIMER	0-99 Seconds in 1 second increments
KILOVOLT METER	0-19.99 digital. 1% accuracy ±1 Least Significant Digit.
MILLIAMP METER	0-19.99 digital. 1% accuracy ±1 Least Significant Digit.
SIZE (W X H X D)	17 X 7.5 X 14.5 inches.
WEIGHT	25 pounds.

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SYM	PART #	DESCRIPTION	QTY
5400DT AC HYPOT® PLUS / 5450DT AC/DC HYPOT® PLUS			
	04040A-08	CABLE ASSY HV	1
	02100A-13	CABLE ASSY RETURN	1
	33189	CABLE INPUT CORDSET USA BLK 7.5F	1
5400DT-01 / 5450DT-01 FINAL ASSY			
PS801	36722	POWER SUPPLY, LOW VOLTAGE	1
	36405	KNOB BLACK PLASTIC .71 OD	1
T801	5400DT-35	TRANSFORMER ASSY HV 5000V 20MA	1
J804,805	05400DT-18	HARNESS ASSY POWER SUPPLY	1
5400DT-02 / 5450DT-02 PANEL ASSY CONTROL			
C604	15575	CAPACITOR HV .1MFD 600V	1
C605	15217	CAPACITOR HV .001MFD 1KV	1
D600-603	36364	DIODE LED GREEN RECTANGULAR	4
D604-608	36362	DIODE LED RED RECTANGULAR	5
J603	05400DT-36	RECEPTACLE HV	1
J604	05400DT-34	JACK FEMALE HV ASSY	1
J605	05400DT-11	HARNESS ASSY RETURN	1
J611	05400DT-09	HARNESS ASSY PANEL CONTROL	1
I600,602,603	35467	LAMP INCANDESCENT 6.3	3
I604	36623	ALARM	1
M601,602	37456	METER DIGITAL 2V DC FS	2
R602	35664	RESISTOR VARIABLE 5K 2W 10%	1
S600,601	35449	SWITCH SPDT PUSH BUTTON MOMENTARY	2
FOR S600	35451	LENS RED SQUARE	1
FOR S601	35453	LENS LIGHT GREEN SQUARE	1
S602,603	35450	SWITCH DPDT PB ALT.	2
FOR S602	36624	PUSHBUTTON LENS SQUARE WHITE	1
FOR S603	35452	LENS YELLOW SQUARE	1
S604,605	05400DT-13	SWITCH ASSY THUMBWHEEL	2
S606*	36893	SWITCH WITH FLATTED HANDLE	1

* USED ON 5450DT ONLY

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SYM	PART #	DESCRIPTION	QTY
5400DT-03 / 5450DT-03 PANEL ASSY REAR			
F701,702	36888	FUSE 1.6 AMP 5X20mm SLOW BLOW	2
	05400DT-12	HARNESS ASSY GROUND	1
P701	05400DT-17	MODULE ASSY INPUT	1
	05400DT-23	HARNESS ASSY LEAKAGE SETPOINT	1
J703	36764	CONNECTOR 7 CIRCUIT	1
FOR J703	35892	COVER CONNECTOR 7 CKT	1
J704	35471	CONNECTOR 3 CIRCUIT	1
FOR J704	35479	COVER CONNECTOR 3 CIRCUIT	1
	36637	CORD WRAP	4
J706	36627	TERMINAL POST GROUND	1
J707	35665	CONNECTOR, 10 POS	1
R731,732	36629	RESISTOR VARIABLE 10K 10 TURNS	2
FOR R731,732	36628	DIAL TURNS-COUNTING	2
R733,734*	36629	RESISTOR VARIABLE 10K 10 TURNS	2
FOR R733,734*	36628	DIAL TURNS-COUNTING	2
	36772	PLUG SNAP FOR.375 HOLE DIA	2

* USED ON 5450DT ONLY

05002D-04 PCB ASSY MOTHER BOARD			
C2,4-7,9,11,13	36673	CAPACITOR CERAMIC .1MF 50V	8
C8,12	18427	CAPACITOR ELECTROLYTIC 1MFD 50VDC	2
C10	34514	CAPACITOR ELEC 10MFD 16 VOLT	1
D1-4	34513	DIODE SIL 75PIV 10MA 1N4148	4
D5-10	34933	DIODE SIL 1000PIV 1A 1N4007	6
K1-6	35434	RELAY DPDT DIP 5 VOLTS DC 2	6
P1-3	36779	CONNECTOR MALE 80 PIN PCB MOUNT.	3
P4,5	36762	TERMINAL HEADER 12 CONTACTS	2
P6	36780	CONNECTOR MALE 20PIN SIP PCB MOUNT	1
P7	36681	CONNECTOR MALE DIP 20 POS. .1 IN	1
P8	36781	CONNECTOR MALE 26PIN DIP PCB MOUNT	1
P9,10,12,14,15	35670	CONNECTOR MALE HEADER 10 CIRCIUT	5
P13	36378	CONNECTOR MALE 6 POST HDR	1

SYM	PART #	DESCRIPTION	QTY
R1,R4	36785	RESISTOR FIXED 10K 1/4W 1%	2
R2,3	36647	RESISTOR FIXED 33 1/4 W 5%	2
R5	36654	RESISTOR FIXED 5.1K 1/4 W 5%	1
R6,7	36650	RESISTOR FIXED 100 1/4 W 5%	2
TP1-7	35644	TERMINAL STRIP ONE MALE HDR	7
U1	36738	IC QUAD OP AMP TL084ACN	1
U2	36782	IC VOLTAGE REFERENCE 10 V	1

05002D-05 PCB ASSY LOGIC

C100,105,125, 127,131	35635	CAPACITOR POLY FILM .1 MFD 100V 5%	5
C101	36844	CAPACITOR FILM .001 MF 50 VOLT MIN	1
C102,103, 106-108,111-122, 126,128-130,132, 133,135-140	36673	CAPACITOR CERAMIC .1MF 50V	29
C104	36902	CAPACITOR FILM .56 UF 50 VDC	1
C123	36753	CAPACITOR ELECTROLYT 22 MF 16 VDC	1
C124	34514	CAPACITOR ELEC 10MFD 16 VOLT	1
D100-102	34513	DIODE SIL 75PIV 10MA 1N4148	3
J100	36726	CONNECTOR 80 PIN FEMALE PCB MOUNT.	1
R100	36985	RESISTOR VARIABLE 5M 1/4W 10%	1
R101	36987	RESISTOR FIXED 7.5M 1/4W 5%	1
R102	18375	RESISTOR FIXED 1K 1/4W 5%	1
R103	36655	RESISTOR FIXED 6.8K 1/4 W 5%	1
R104	36799	RESISTOR FIXED 1.6K 1/4W 5%	1
R105,106	36904	RESISTOR FIXED 620K 1/4W 5%	2
R107	36647	RESISTOR FIXED 33 1/4 W 5%	1
R108	36880	RESISTOR FIXED 220K 1/4 W 5 %	1
R109-117,123	35206	RESISTOR FIXED 220 1/4W 5%	10
R118	35645	RESISTOR FIXED 9.1M 1/4W 5%	1
R119	35630	RESISTOR FIXED 47K 1/4W 5%	1

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SYM	PART #	DESCRIPTION	QTY
R120	36883	RESISTOR FIXED 1.5M 1/4 W 5 %	1
R121	36656	RESISTOR FIXED 10K 1/4 W 5%	1
R122	36898	RESISTOR FIXED 178K 1/4W 1%	1
RN100-104	36817	RESISTOR FIXED SIP 10K 2 %	5
RN105	36671	RESISTOR DIP PACK 10K TYPE 1	1
S100	37248	SWITCH DIP 8 POSITIONS	1
TP100-111	35644	TERMINAL STRIP ONE MALE HDR	12
U100	35576	IC TIMER CMOS 7250	1
U101-103,120	35251	IC TIMER 555	4
U104-U106	36605	IC DRIVER 7 CHANNEL SN75468	5
U107	05400DT-27	PROGRAMMABLE LOGIC ASSY SEQUENCER	1
U108	05400DT-26	PROGRAMMABLE LOGIC ASSY FAIL LATCH	1
U110	36677	IC 75452	1
U111	36675	IC 74HC109	1
U112-115,119	36368	IC 74HC14	5
U116-118,121, 122	36674	IC 74HC32	5
FOR U107,108	35724	SOCKET IC 24 PIN 0.3 CNTRS	2
5400DT-06 PCB ASSY ANALOG			
C300,302, C304-316,322-324, C329-331,337-343	36673	CAPACITOR .1MFD 50V CERAMIC	28
C301,303,344	18427	CAPACITOR ELECTROLYTIC 1MFD 50V	3
C317-319, C335,336	36800	CAPACITOR CERAMIC 100PF 100V 5%	5
C320,321, C325,326	36801	CAPACITOR FILM .047UF 100V 10%	4
C327,328	36753	CAPACITOR ELECTROLYTIC 22MF 16VDC	2
C332-334	36802	CAPACITOR FILM .01UF 100V 10%	3
C345	36905	CAPACITOR FILM 1UF 50V 5%	1
D300-314	34513	DIODE 75V 10MA IN4148	15
J300	36726	CONNECTOR 80 PIN FEMALE PCB MOUNT	1

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SYM	PART #	DESCRIPTION	QTY
R300-311,322	36647	RESISTOR FIXED 33 OHM 1/4W 5%	13
R312-314,316, R324,346,349	36828	RESISTOR FIXED 1.0K 1/4W 1%	7
R315,317	36795	RESISTOR FIXED 330 OHM 1/4W 5%	2
R318,319	36796	RESISTOR FIXED 240 OHM 1/4W 5%	2
R320	36654	RESISTOR FIXED 5.1K 1/4W 5%	1
R321	36885	RESISTOR FIXED 750 OHM 1/4W 5%	1
R323	35206	RESISTOR FIXED 220 OHM 1/4W 5%	1
R325	36797	RESISTOR FIXED 360 OHM 1/4W 5%	1
R326,343, R367-370	35094	RESISTOR FIXED 15K 1/4W 1%	6
R330,334	35631	RESISTOR FIXED 1M 1/4W 5%	2
R327,328	35645	RESISTOR FIXED 9.1M 1/4W 5%	2
R329	36881	RESISTOR FIXED 910 OHM 1/4W 5%	1
R331,352	36652	RESISTOR FIXED 499 OHM 1/4W 1%	2
R332,344,353	36785	RESISTOR FIXED 10K 1/4W 1%	3
R333	36799	RESISTOR FIXED 1.6K 1/4W 5%	1
R335	36990	RESISTOR FIXED 165K 1/4W 1%	1
R336	36939	RESISTOR FIXED 90.9K 1/4W 1%	1
R337	35633	RESISTOR VARIABLE 200K 1/4W 10%	1
R338	36943	RESISTOR FIXED 46.4K 1/4W 1%	1
R340	36940	RESISTOR FIXED 97.6K 1/4W 1%	1
R341,339	50206	WIRE 20AWG SOLID TINNED	2
R342	36944	RESISTOR FIXED 54.9K 1/4W 1%	1
R345	36783	RESISTOR FIXED 10 OHM 1/4W 1%	1
R347	36655	RESISTOR FIXED 6.8K 1/4W 5%	1
R348	36798	RESISTOR FIXED 20K 1/4W 1%	1
R350,351,365	36794	RESISTOR FIXED 2K 1/4W 1%	3
R354,360,362	36756	RESISTOR VARIABLE 1K RT ANGLE	3
R355-359,361, R363,364	36758	RESISTOR VARIABLE 10K RT. ANGLE	8
R366	36887	RESISTOR FIXED 150 OHM 1/4W 5%	1
RN300-302	36668	RESISTOR DIP PACK 1K TYPE 3	3

SYM	PART #	DESCRIPTION	QTY
RN303-307	36670	RESISTOR DIP PACK 10K TYPE 3	5
Q300	34517	TRANSISTOR PNP TIP42	1
TP300-308	35644	TERMINAL STRIP ONE MALE HDR	9
U300	36984	IC QUAD OP AMP AD704	1
U301-305, 310	36738	IC QUAD OP AMP TL084ACN	6
U306, 308	36737	IC ANALOG SWITCH DUAL SPDT	2
U307	36680	IC LM339	1
U309	36368	IC 74HC14	1
05002D-07 PCB ASSY DRIVER			
C200,202-208, 211,213-218 220-223,244, 248-251	36673	CAPACITOR CERAMIC .1MF 50V	24
C209,241,255	36801	CAPACITOR FILM .047 UF 100V 10 %	3
C210, 254	36902	CAPACITOR FILM .56 UF 50 VDC	2
C212	35635	CAPACITOR POLY FILM .1 MFD 100V 5%	1
C224-226	36806	CAPACITOR 1.0 MF 35 VOLT TANT 10 %	3
C227	36805	CAPACITOR .68 MF 35 VOLT TANT 10 %	1
C228, 229	36807	CAPACITOR 3.3 MF 35 VOLT TANT 10 %	2
C230	36808	CAPACITOR 4.7 MF 35 VOLT TANT 10%	1
C231-233,252	36810	CAPACITOR 10.0 MF 25 VOLT TANT 10%	4
C234,239	36809	CAPACITOR 6.8 MF 25 VOLT TANT 10%	2
C235,236,253	36811	CAPACITOR 33.0 MF 10 VOLT TANT 10%	3
C237	36812	CAPACITOR 47.0 MF 6 VOLT TANT 10 %	1
C238	36800	CAPACITOR CERAMIC 100 PF 100 V 5%	1
C239	36844	CAPACITOR FILM .001 MF 50 VOLT MIN	1
C242	36905	CAPACITOR FILM 1 UF 50V 5%	1
C243	36917	CAPACITOR 270 PF 100 V 5%	1
C245	34514	CAPACITOR ELEC 10MFD 16 VOLT	1
C246, 247	18427	CAPACITOR ELECTROLYTIC 1MFD 50VDC	2
D200	34513	DIODE SIL 75PIV 10MA 1N4148	1
J200	36726	CONNECTOR 80 PIN FEMALE PCB MOUNT.	1

SYM	PART #	DESCRIPTION	QTY
K200	34978	RELAY REED 2PST	1
P201,202	36379	CONNECTOR MALE 2 POST HDR	2
R200,201, 203-205,257,273	36758	RESISTOR VARIABLE 10K RT.ANGLE 10%	7
R202, 252	36244	RESISTOR VARIABLE 2M 1/4W 10%	2
R206	36942	RESISTOR VARIABLE 50K .25W 10%	1
R207	36985	RESISTOR VARIABLE 5M 1/4W 10%	1
R208-211, 218-221	36859	RESISTOR FIXED 12K 1/4W 5%	8
R212, 215	36908	RESISTOR FIXED 1.3K 1/4W 5%	2
R213,214,286	36828	RESISTOR FIXED 1.0K 1/4W 1%	3
R216,222,226, 229,284,285	18375	RESISTOR FIXED 1K 1/4W 5%	6
R217	36929	RESISTOR FIXED 43K 1/4W 5%	1
R223, 225, 250	36666	RESISTOR FIXED 20K 1/4 W 5%	3
R227	35094	RESISTOR FIXED 15K 1/4W 1%	1
R228,263	36909	RESISTOR FIXED 68K 1/4W 5%	2
R230,231,241, 248,251,260-262	36654	RESISTOR FIXED 5.1K 1/4 W 5%	11
R238, 272 R268,278,290	36912	RESISTOR FIXED 2K 1/4W 5%	2
R232	36864	RESISTOR FIXED 82K 1/4W 5%	1
R233	36795	RESISTOR FIXED 330 1/4W 5%	1
R236	35631	RESISTOR FIXED 1M 1/4W 5%	1
R237,276,277, 280,283	36656	RESISTOR FIXED 10K 1/4 W 5%	5
R239	36863	RESISTOR FIXED 62K 1/4W 5%	1
R242	36916	RESISTOR FIXED 825K 1/4W 1%	1
R243, 244	36785	RESISTOR FIXED 10K 1/4W 1%	2
R245	36987	RESISTOR FIXED 7.5M 1/4W 5%	1
R246, 247, 253-256, 266	36647	RESISTOR FIXED 33 1/4 W 5%	7
R249	35222	RESISTOR FIXED 680 1/4W 5%	1

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SYM	PART #	DESCRIPTION	QTY
R256	37220	CAPACITOR TANTALUM 68UF 16V	1
R258,259,264, 274,281,282	36914	RESISTOR FIXED 100K 1/4W 5%	6
R265	36653	RESISTOR FIXED 3.3K 1/4 W 5%	1
R269	36862	RESISTOR FIXED 75 1/4W 5%	1
R279	36915	RESISTOR FIXED 9.1K 1/4W 5 %	1
R287	36783	RESISTOR FIXED 10 1/4W 1 %	1
R288	36651	RESISTOR FIXED 130 1/4 W 5%	1
R289	36832	RESISTOR FIXED 681K 1/4W 1%	1
RN200	36817	RESISTOR FIXED SIP 10K 2 %	1
TP200-208	35644	TERMINAL STRIP ONE MALE HDR	9
U200, 201	36816	IC LINEAR FOUR QUAD MULTIPLIER	2
U202	36813	IC OSCILLATOR VOLTAGE CONTROLLED	1
U203, 216	36737	IC ANALOG SWITCH DUAL SPDT	2
U204-206	36738	IC QUAD OP AMP TL084ACN	3
U207	36814	IC 8-BIT MAGNITUDE COMPARATOR	1
U208	35576	IC TIMER CMOS 7250	1
U209, 210, 217	36368	IC 74HC14	3
U211	36867	IC NAND BUFFER 74LS26	1
U212, U222	34519	TRANSISTOR PNP 2N3906	2
U213,214,219	36815	IC HEX BUFFER W/HV OUTPUTS	3
U215	36680	IC LM339	1
U218	36907	IC 74HC573 OCTAL TRANS LATCH	1
U220	36906	IC 74HC30 8-INPUT NAND GATE	1
U221	36674	IC 74HC32	1
U223	34518	TRANSISTOR NPN 2N3904	1
	05400DT-36	"RECEPTACLE ASSY, MODIFIED"	1

05002D-15 PCB ASSY INDICATOR

C600,602,603	36673	CAPACITOR CERAMIC .1MF 50V	3
C604,C605	36810	CAPACITOR 10.0 MF 25 VOLT TANT 10%	2
J600-601	36773	CABLE STRIP FLAT 2 IN	2
J602	36774	CABLE STRIP FLAT 7 IN	1

SYM	PART #	DESCRIPTION	QTY
P602,P603, P605,P606	36379	CONNECTOR MALE 2 POST HDR	4
R602	36887	RESISTOR FIXED 150 1/4W 5%	1
5400DT-16 PCB ASSY HV POWER AMPLIFIER			
L400	36988	INDUCTOR TOROID 1mH	1
	05400DT-31	PCB ASSY GATE DRIVE	1
	05400DT-32	PCB ASSY ANALOG/PWM	1
	36736	PCB HV POWER AMP	1
BR400	36501	RECTIFIER BRIDGE 10A 600V	1
BR401	36842	RECTIFIER BRIDGE 1.5A 50PIV	1
C400,401	36837	CAPACITOR ELECT. 470MF 200VDC	2
C402,403	36846	CAPACITOR ELECTROLYTIC 330MF 50V	2
C404,405	36847	CAPACITOR ELECTROLYTIC 100MF 25V	2
C406,413	36845	CAPACITOR FILM 4.7MA 50V	2
C407	36840	CAPACITOR ELECT. 4700MF 6.3VDC	1
C408,410	36838	CAPACITOR CERAMIC 270PF 1KV	2
C409,412	36839	CAPACITOR FILM .0022MF 63V	2
C411	36918	CAPACITOR 4700PF	1
C414	36927	CAPACITOR FILM 0.22MF 50V 5%	1
C415,416	36801	CAPACITOR FILM .047UF 100V 10%	2
C417	36905	CAPACITOR FILM 1MF 50V	1
C418	36802	CAPACITOR FILM .01MF 100V	1
D400-403	36848	DIODE FAST RECOVERY MUR460	4
D404	34933	DIODE SIL 1000PIV 1A 1N4007	1
D409,410	34513	DIODE SIL 75PIV 10MA 1N4148	2
D411	36925	DIODE ZENER 1N4740 10V 1W	1
J400	35665	CONNECTOR FEMALE POLAR SOCKET	1
FOR J400	36770	HEADER PCB 10 POS DIP	1
K400	35432	RELAY SPDT 5VDC 5A	1
P401	36754	CONNECTOR LOCKING HEADER 3 PIN	1
P402	36765	CONNECTOR 7 CIRCUIT END MALE	1
R400,401	36824	RESISTOR FIXED 22K 5W 5%	2

SYM	PART #	DESCRIPTION	QTY
R402	36833	RESISTOR FIXED 34K 1/4W 1%	1
R403	35630	RESISTOR FIXED 47K 1/4W 5%	1
R405,406	36647	RESISTOR FIXED 33 OHM 1/4W 5%	2
R407,408	36826	RESISTOR FIXED .1 OHM 1W 5%	2
R409	36669	RESISTOR FIXED 39K 1/4W 5%	1
R410	36831	RESISTOR FIXED 47 OHM 1W 5%	1
R412	36832	RESISTOR FIXED 681K 1/4W 1%	1
R413	36656	RESISTOR FIXED 10K 1/4W 5%	1
R414	36859	RESISTOR FIXED 12K 1/4W 5%	1
Q400,401	36853	TRANSISTOR MOSFET IRF840	2
Q402	36964	TRANSISTOR 2N2222	1
T400	36850	TRANSFORMER INPUT	1
T401	36851	TRANSFORMER POWER	1
TH400,401	36836	THERMISTOR CL150	2
TP400	35644	TERMINAL STRIP ONE MALE HDR	1
U400	36691	IC 7815	1
U401	36692	IC 7915	1
U402	36991	IC OPTOCOUPLER VDE SPACING	1
	36723	BRACKET POWER AMPLIFIER	1
	36771	TRANSISTOR INSULATOR	2
	36823	TRANSISTOR TAPE INSULATING	1

5400DT-19 PCB ASSY HV INTERFACE (5400DT ONLY)

D500	34933	DIODE SIL 1000PIV 1A 1N4007	1
J501	35665	CONNECTOR FEMALE 10 POS. DIP	1
K500	35432	RELAY SPDT 5VDC 5A	1
P500-504,506	35500	TERMINAL TAB CONNECTOR .187DB	6
P505	36770	HEADER PCB 10 POS. DIP	1
R500	36690	RESISTOR FIXED 100M 3.5W 1%	1
R501	35092	RESISTOR FIXED 10K 1/4W 1%	1
R502	36783	RESISTOR FIXED 10 OHM 1/4W 1%	1
C500	36673	CAPACITOR CERAMIC .1MF 50V	1

SYM	PART #	DESCRIPTION	QTY
5450DT-19 PCB ASSY HV INTERFACE (5450DT ONLY)			
C500	36673	CAPACITOR CERAMIC .1MF 50V	1
C501	19626	CAPACITOR HV .25MFD 5KV DC	1
D500,502,503, D504	34933	DIODE SIL 1000PIV 1A 1N4007	4
D501	36958	DIODE SILICON HV 25KV	1
J501	35665	CONNECTOR FEMALE 10 POS DIP	1
K500	35432	RELAY SPDT 5V DC 5A	1
K503	36959	RELAY SPST NC HV	1
K501,502	36919	RELAY SPST NO HV	2
K504	36960	RELAY SPST NC HV	1
P505	36770	HEADER PCB 10 POS. DIP	1
P500-504,506, P507	35500	TERMINAL TAB CONNECTOR .187 DB	6
Q501	34517	TRANSISTOR PNP TIP42	1
Q500	34516	TRANSISTOR NPN TIP41	1
R500	36690	RESISTOR FIXED 100 M OHM 3.5W 1%	1
R501,507	35092	RESISTOR FIXED 10K 1/4W 1%	2
R505	36828	RESISTOR FIXED 1.0K 1/4W 1%	1
R503	36968	RESISTOR FIXED 1M 10W 1%	1
R502	10904	RESISTOR FIXED 10 OHM 1/2W 1%	1
R504	36268	RESISTOR FIXED 5K 10W 1%	1
R508	36793	RESISTOR FIXED 100 OHMS 1/4W 1%	1
JU500	36010	CABLE 18AWG 1 CONDUCTOR WHITE	.500
05002D-25 INTERFACE ASSY REMOTE I/O			
C700-704, 708-735	36673	CAPACITOR CERAMIC .1MF 50V	33
C705,706, 740,741	36810	CAPACITOR 10.0 MF 25 VOLT TANT 10%	4
C707	36801	CAPACITOR FILM .047 UF 100V 10 %	1
C736,737	18427	CAPACITOR ELECTROLYTIC 1MFD 50VDC	2
C738,739	36753	CAPACITOR ELECTROLYT 22 MF 16 VDC	2

ASSOCIATED RESEARCH INC.	REPLACEMENT PARTS LIST MODEL SERIAL # 5400DT 363 TO DATE 5450DT 466 TO DATE	REVISION Q ECO 4555 DATE 4-8-94 PAGE 12 OF 13

SYM	PART #	DESCRIPTION	QTY
D700,701,703, 704	34513	DIODE SIL 75PIV 10MA 1N4148	4
D702,705,706	36932	DIODE SIL ZENER 11V 1N4741A	3
J702	36778	CONNECTOR FEM 25 PIN SUB D PCB MTG	1
PART OF J701	35625	CABLE RIBBON 10 CONDUCTOR	1
PART OF J701	35665	CONNECTOR FEMALE 10 POS DIP	1
PART OF J701	35777	CONNECTOR FEMALE 26 CONT RIBBON	1
PART OF J701	35783	CABLE RIBBON 26 CONDUCTOR	1
PART OF J701	36770	HEADER PCB 10 POS. DIP	1
PART OF J701	35798	CONNECTOR TRANSITION 26 CONT	1
R700,701, 704,706	36758	RESISTOR VARIABLE 10K RT.ANGLE 10%	4
R702,705	36654	RESISTOR FIXED 5.1K 1/4 W 5%	2
R703,707,712, 715,716,731,732	36650	RESISTOR FIXED 100 1/4 W 5%	7
R708-711	36647	RESISTOR FIXED 33 1/4 W 5%	4
R713,714	36656	RESISTOR FIXED 10K 1/4 W 5%	2
R717	36666	RESISTOR FIXED 20K 1/4 W 5%	1
RN700	36668	RESISTOR DIP PACK 1K TYPE 3	1
TP1-4	35644	TERMINAL STRIP ONE MALE HDR	4
U700,701	36738	IC QUAD OP AMP TL084ACN	2
U702	36931	IC VOLTAGE REGULATOR -5 V	1
U703	36930	IC VOLTAGE REGULATOR +5 V	1
5400DT-31 PCB ASSY GATE DRIVE			
D412-417	34513	DIODE SIL 75PIV 10MA 1N4148	6
R419,423	18375	RESISTOR FIXED 1K 1/4W 5%	2
R420,424	35206	RESISTOR FIXED 220 OHM 1/4W 5%	2
R421,425	36825	RESISTOR FIXED 27K 1/4W 5%	2
R422,426	36795	RESISTOR FIXED 330 OHM 1/4W 5%	2
Q403,404	36964	TRANSISTOR NPN 2N2222	2
T402,403	05400DT-30	TRANSFORMER ASSY GATE DRIVE	2

ASSOCIATED RESEARCH INC.	REPLACEMENT PARTS LIST MODEL SERIAL # 5400DT 363 TO DATE 5450DT 466 TO DATE	REVISION Q ECO 4555 DATE 4-8-94 PAGE 13 OF 13

SYM	PART #	DESCRIPTION	QTY
5400DT-32 PCB ASSY ANALOG/PWM			
C409,425	36917	CAPACITOR 270PF 100V 5%	2
C420,423, C426,427	36673	CAPACITOR .1MFD 50V CERAMIC	4
C419	36927	CAPACITOR FILM .022MF 50V 5%	1
C421,424	36905	CAPACITOR FILM 1MF 50V	2
C422	36844	CAPACITOR FILM .001MF 50V	1
D418	36849	DIODE SIL ZENER 6.8V 1N476B	1
D419	35688	DIODE SIL ZENER 4.7V 1N5230B	1
R414	36833	RESISTOR FIXED 34K 1/4W 1%	1
R426	36834	RESISTOR FIXED 3.32K 1/4W 1%	1
R427	36832	RESISTOR FIXED 681K 1/4W 1%	1
R428,433,436, R437	36828	RESISTOR FIXED 1K 1/4W 1%	4
R429,432	36829	RESISTOR FIXED 1.2K 1/4W 5%	2
R430,434	36827	RESISTOR FIXED 5.11K 1/4W 1%	2
R431	35094	RESISTOR FIXED 15K 1/4W 1%	1
R435	36830	RESISTOR FIXED 560 OHM 1/4W 5%	1
R438	35222	RESISTOR FIXED 680 OHM 1/4W 5%	1
R439	36795	RESISTOR FIXED 330 OHM 1/4W 5%	1
Q405	36964	TRANSISTOR NPN 2N2222	1
Q406	36852	TRANSISTOR PNP 2N2907	1
U403	36854	IC PWM SG3731	1
U404	36855	IC COMPARATOR LM311N	1
	36923	CONNECTOR MALE 7 POS. RT. ANGLE	1

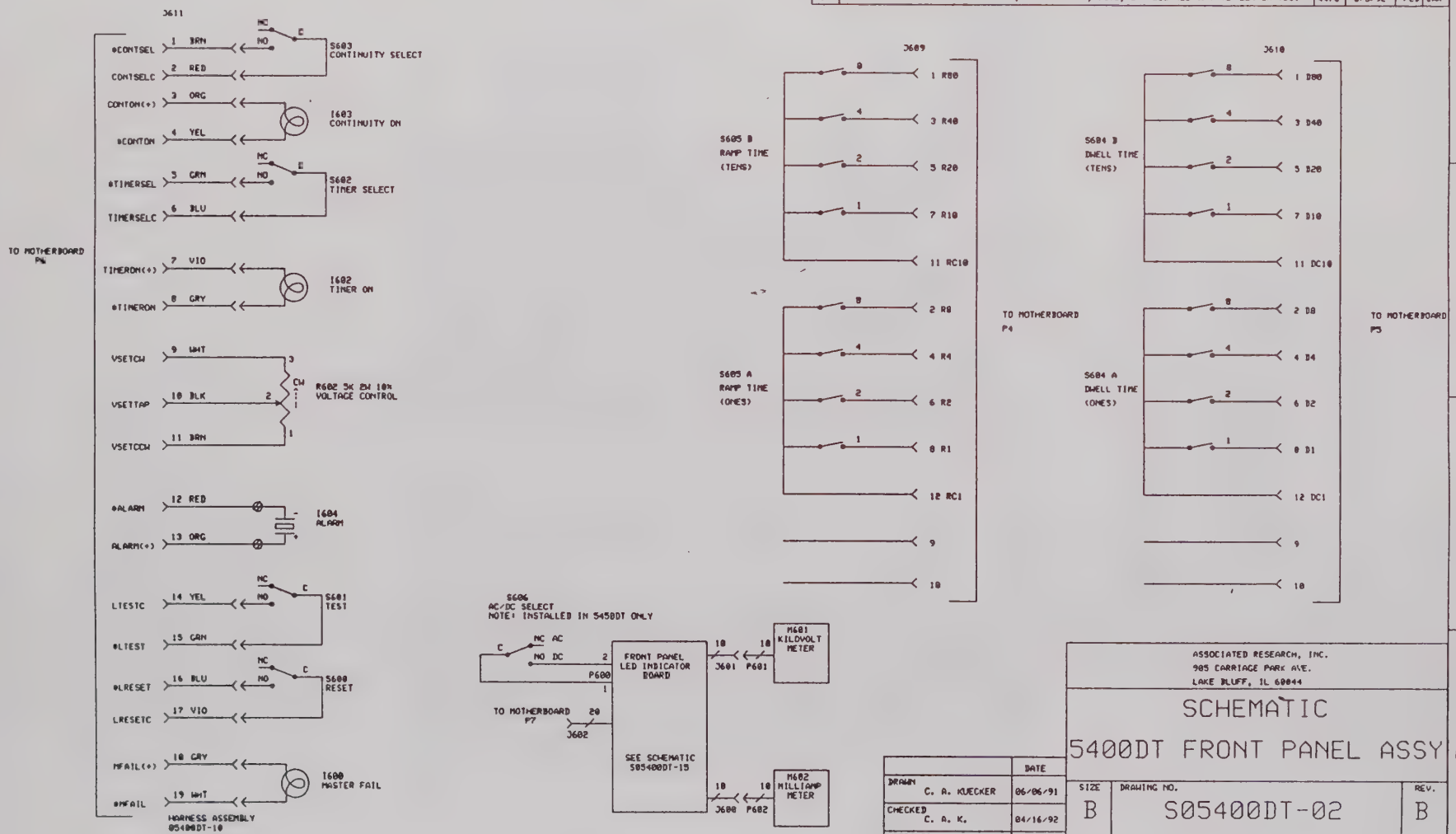
SECTION IV

SCHEMATIC

MODELS 5400DT, 5450DT

SIZE	DOCUMENT #	PGS	DOCUMENT DESCRIPTION
B	S05400DT	1	SCHEMATIC INDEX, 5400DT AND 5450DT
B	S05400DT-02	2	CONTROL PANEL ASSEMBLY
B	S05400DT-03	2	REAR PANEL ASSEMBLY
B	S05002D-04	3	MOTHER BOARD ASSEMBLY
B	S05002D-05	4	LOGIC ASSEMBLY
B	S05400DT-06	3	ANALOG ASSEMBLY
B	S05002D-07	4	DRIVER ASSEMBLY
B	S05002D-15	1	INDICATOR ASSEMBLY
B	S05400DT-16	1	HV POWER AMPLIFIER ASSEMBLY
B	S05400DT-19	1	HV INTERFACE ASSEMBLY (5400DT)
B	S05450DT-19	1	HV INTERFACE ASSEMBLY AC/DC (5450DT)
B	S05002D-25	2	REMOTE INTERFACE ASSEMBLY
B	S05400DT-31	1	GATE DRIVE ASSEMBLY
B	S05400DT-32	1	ANALOG/PWM ASSEMBLY

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
A	ADDED L603, L802, C605	4471	4/24/92	FCB	CAK
B	ADDED RETURN LEAD TO TB01 CORE, ADDED J804, J612, CHANGED RED/WHT TO BLK ON TB01	4478	6/5/92	FCB	CAK



ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC
5400DT FRONT PANEL ASSY

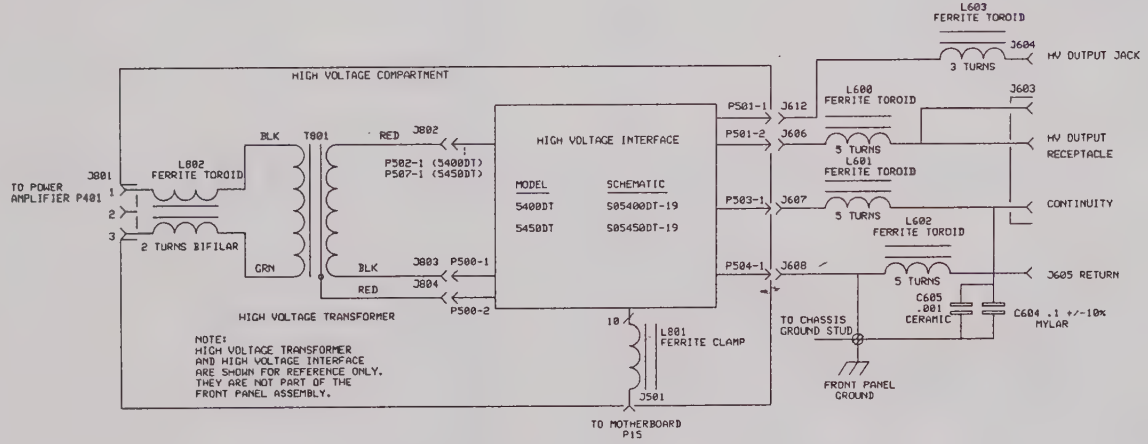
		DATE
DRAWN	C. A. KUECKER	06/06/91
CHECKED	C. A. K.	04/16/92
APPROVED	F. C. B.	04/16/92

SIZE	DRAWING NO.	REV.
B	S05400DT-02	B

SCALE NONE | FILE: 5400FPB.FSH | SHEET 1 OF 2

8 7 6 5 4 3 2 1

D C B A



		DATE
DRAWN	C. A. KUECKER	06/06/91
CHECKED	C. A. K.	04/16/92
APPROVED	F. C. B.	04/16/92

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SCHEMATIC

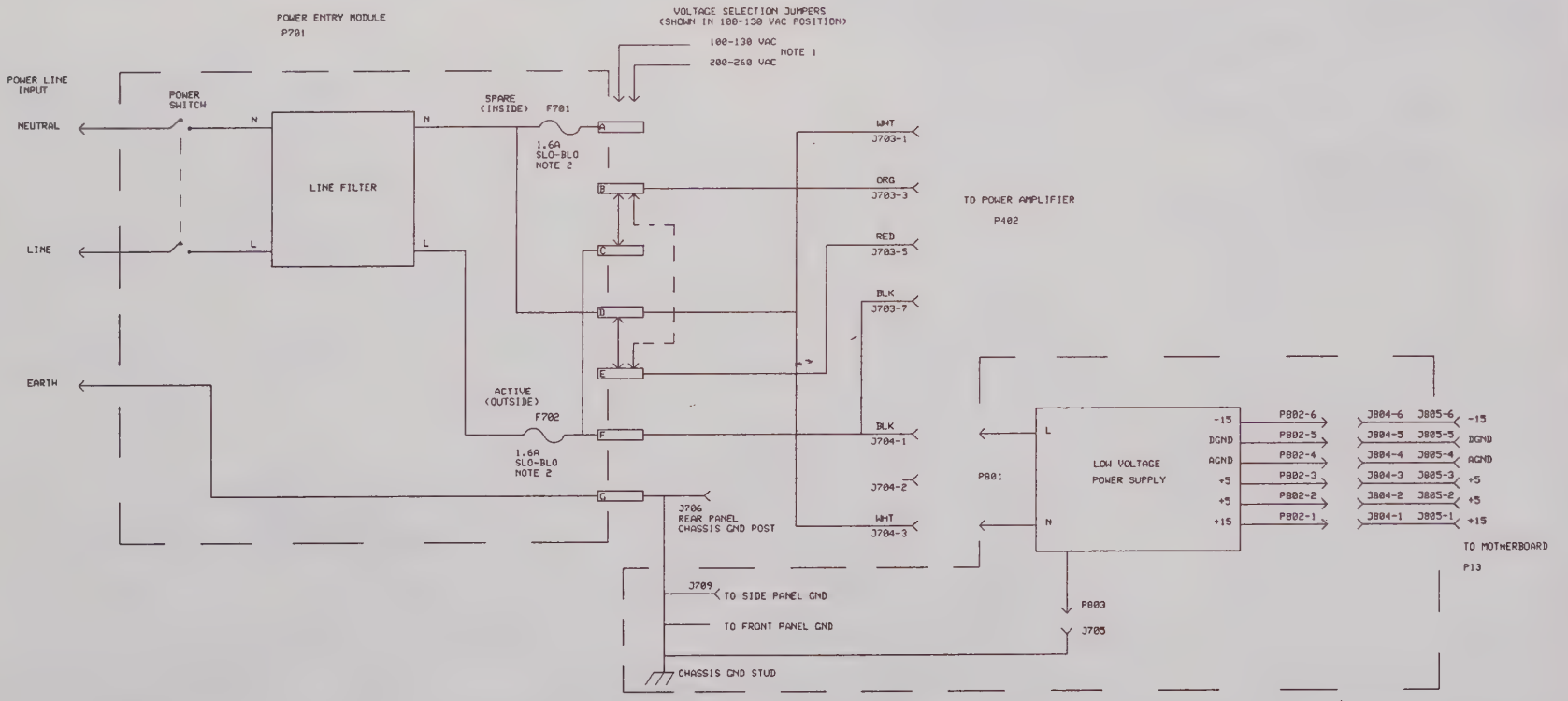
5400DT FRONT PANEL ASSY

SIZE	DRAWING NO.	REV.
B	S05400DT-02	B

SCALE NONE | FILE: 5400FPB.FSH | SHEET 2 OF 2

8 7 6 5 4 3 2 1

D C B A



NOTE: LOW VOLTAGE POWER SUPPLY AND CABLE ARE SHOWN FOR REFERENCE ONLY. THEY ARE NOT PART OF THE REAR PANEL ASSEMBLY.

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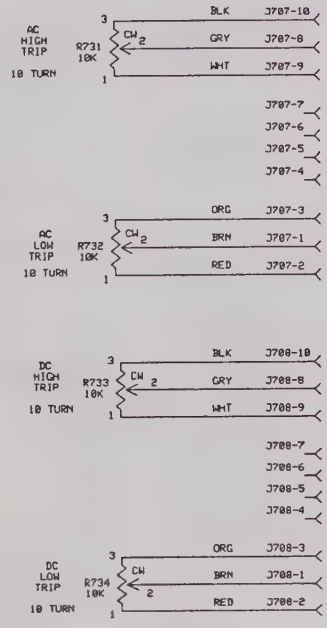
SCHEMATIC
REAR PANEL ASSY

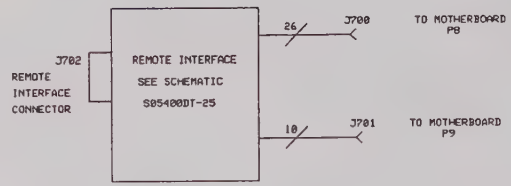
		DATE
DRAWN	ROGER BALD	06/12/91
CHECKED	RB	06-13-91
APPROVED	FCB	06-13-91

SIZE	DRAWING NO.	REV.
B	S05400DT-03	B

SCALE | FILE: 5400-03B.FSH | SHEET 1 OF 2

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
A	CHANGED WIRING CONNECTIONS TO J703 AND J704.	4421	07-08-91	FCB	RB
B	ADDED J709 FOR SIDE PANEL GND	4486	07-17-91	FCB	RB





NOTES

1. TO CHANGE SELECTED VOLTAGE, REMOVE THE FUSE CARTRIDGE USING A SMALL BLADE SCREWDRIVER. SELECT THE DESIRED VOLTAGE BY MATCHING THE ARROW ON THE FUSE CARTRIDGE TO THE ARROW ON THE BODY OF THE POWER MODULE.

2. BEFORE CHANGING THE FUSE, NOTE WHICH VOLTAGE SELECTION ARROW (110-120 OR 220-240) ON THE CARTRIDGE IS ALIGNED WITH THE ARROW ON THE POWER MODULE BODY. TO CHANGE THE FUSE, REMOVE THE FUSE CARTRIDGE USING A SMALL BLADE SCREWDRIVER. REINSERT THE FUSE CARTRIDGE, MAKING SURE THE SAME VOLTAGE SELECTION ARROW ON THE CARTRIDGE IS ALLIGNED WITH THE POWER MODULE BODY.

3. R733 AND R734 ARE USED ON MODEL 5450DT ONLY

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SCHEMATIC
REAR PANEL ASSY

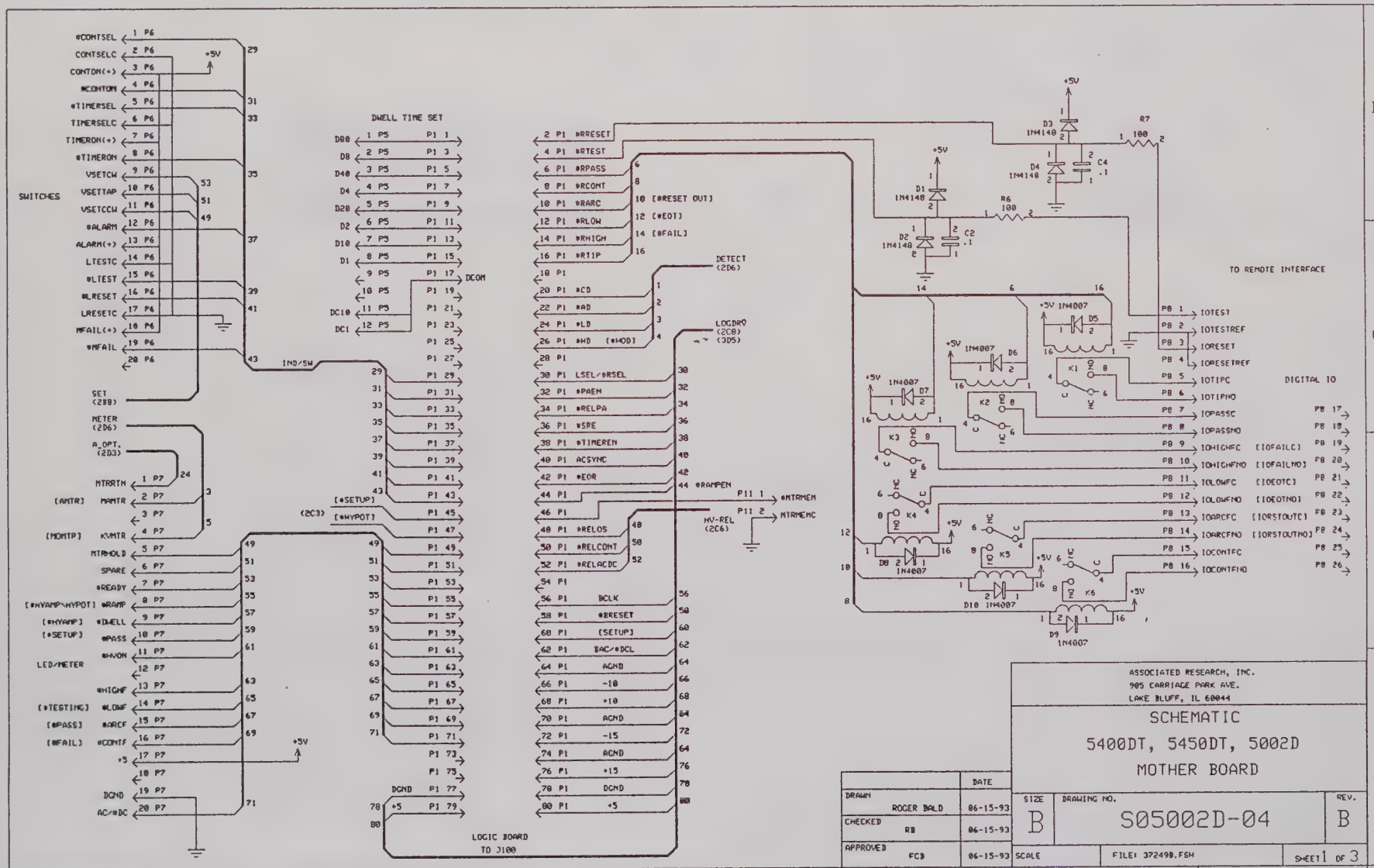
		DATE
DRAWN	ROGER BALD	06/12/91
CHECKED	RB	06-13-91
APPROVED	FCB	06-13-91

SIZE	DRAWING NO.	REV.
B	S05400DT-03	B

SCALE | FILE: 5400-03B.FSH | SHEET 2 OF 2

8 7 6 5 4 3 2 1

D C B A



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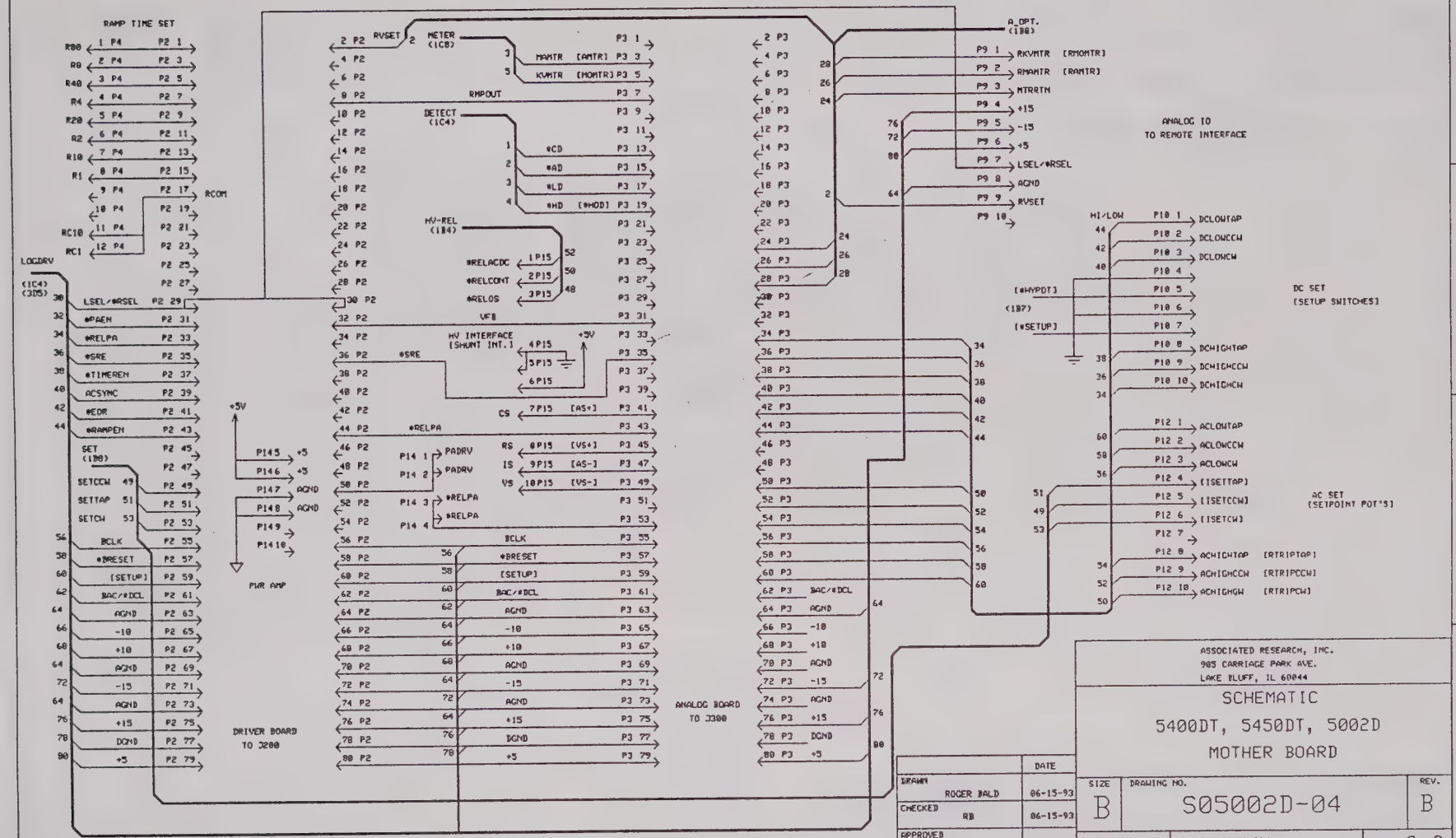
LAKE BLUFF, IL 60044

SCHEMATIC
5400DT, 5450DT, 5002D
MOTHER BOARD

		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	06-15-93
APPROVED	FCB	06-15-93

SIZE: B | DRAWING NO.: S05002D-04 | REV.: B
SCALE | FILE: 37249B.FSH | SHEET 1 OF 3



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LAKE BLUFF, IL 60044

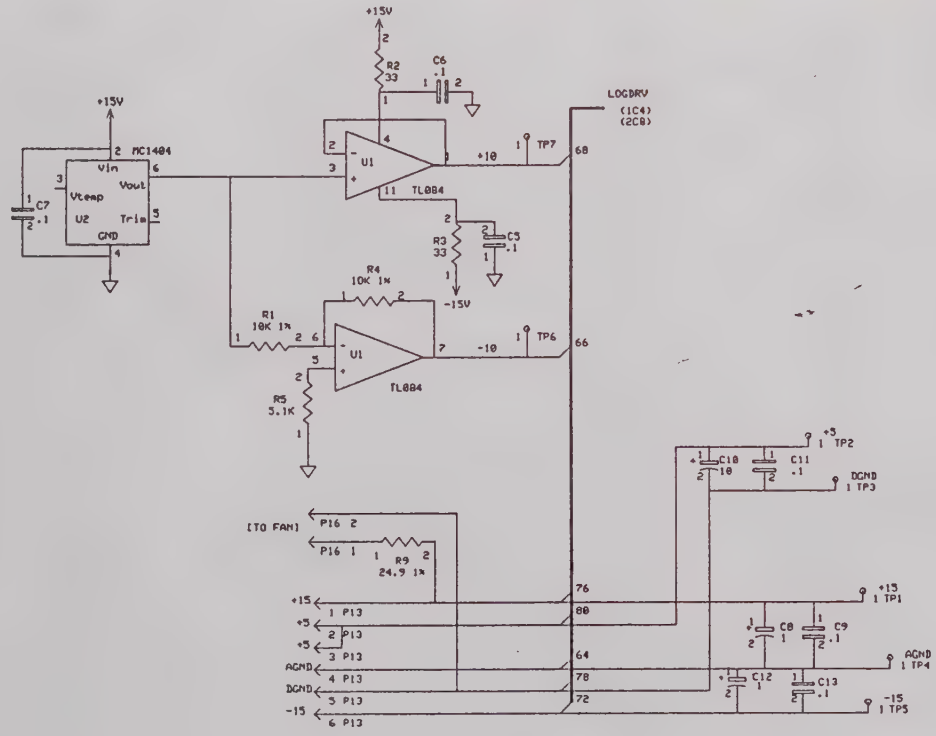
SCHEMATIC
5400DT, 5450DT, 5002D
MOTHER BOARD

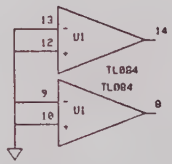
		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	06-15-93
APPROVED	FCB	06-15-93

SIZE	DRAWING NO.	REV.
B	S05002D-04	B

SCALE | FILE: 37249B.FSH | SHEET 2 OF 3

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	COPIED 5400DT-04 REV. B SCHEMATIC AND ADDED SIGNALS FOR 5002D, ADDED R8, R9, P16.	-	06-15-93	RB	RB
A	DELETED C TO NO JUMPERS ON K1-K6 AND UPDATED PCB TO REV A.	4530	07-29-93	RB	FCB
B	DELETED R8	4528	09-03-93	RB	RB





NOTES:

1. UNLESS OTHERWISE NOTED ALL CAPACITOR VALUES ARE IN uF AND RESISTORS ARE 1/4W 5%.
2. BRACKETED SIGNAL NAMES [ ] REFERENCE 5002D, OTHERS ARE COMMON TO ALL MODELS OR 54XXDT ONLY.

REFERENCE DESIGNATORS

LAST USED		NOT USED
C13	R9	C1
D18	TP7	C3
K6	U2	R8
P16		

	DATE
DRAWN ROGER BALD	06-15-93
CHECKED RB	06-15-93
APPROVED FCB	06-15-93

ASSOCIATED RESEARCH, INC.
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LAKE BLUFF, IL 60044

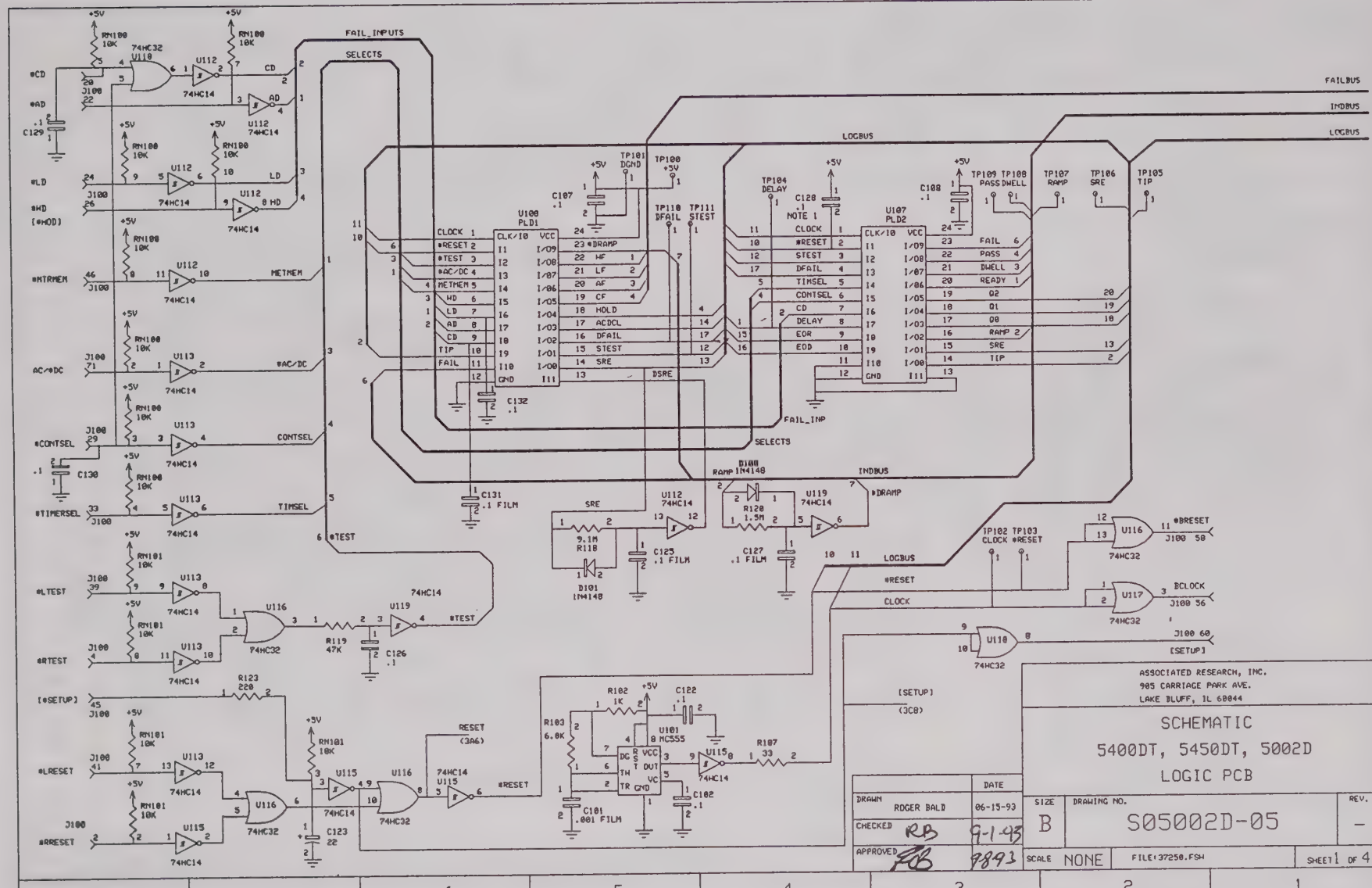
SCHEMATIC
5400DT, 5450DT, 5002D
MOTHER BOARD

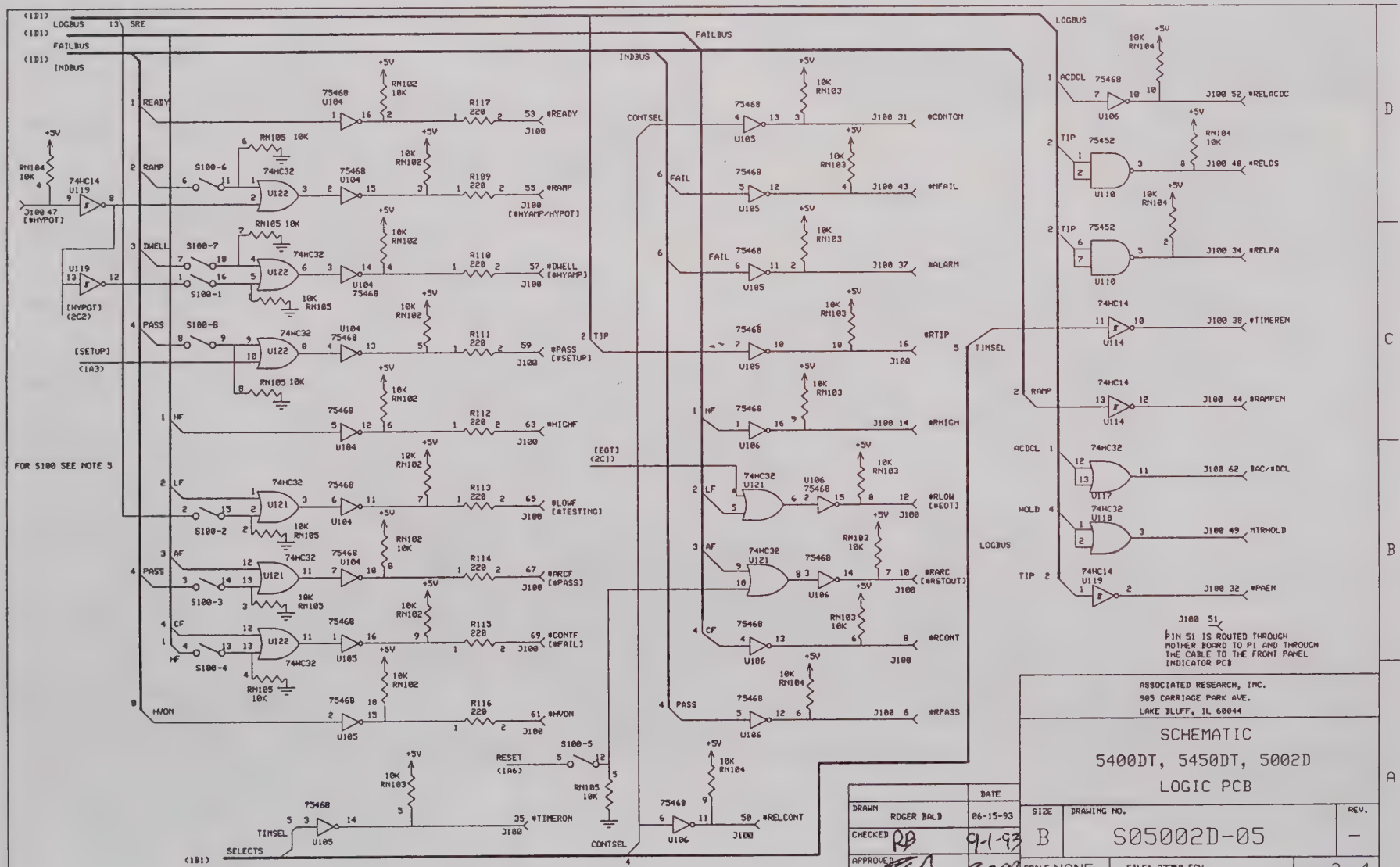
SIZE	DRAWING NO.	REV.
B	S05002D-04	B

SCALE | FILE: 37249B.FSH | SHEET 3 OF 3

8 7 6 5 4 3 2 1

D C B A


FAIL_INPUTS
SELECTS
FAILBUS
INDBUS
LOGBUS
FAIL_INP
SELECTS
INDBUS
LOGBUS
[SETUP]
(3C8)
RESET
(3A6)
ASSOCIATED RESEARCH, INC.
985 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044
SCHEMATIC
5400DT, 5450DT, 5002D
LOGIC PCB
DRAWN ROGER BALD 06-15-93
CHECKED RB 9-1-93
APPROVED 9893
SIZE B
DRAWING NO. S05002D-05
REV. -
SCALE NONE
FILE:37250.FSH
SHEET 1 OF 4



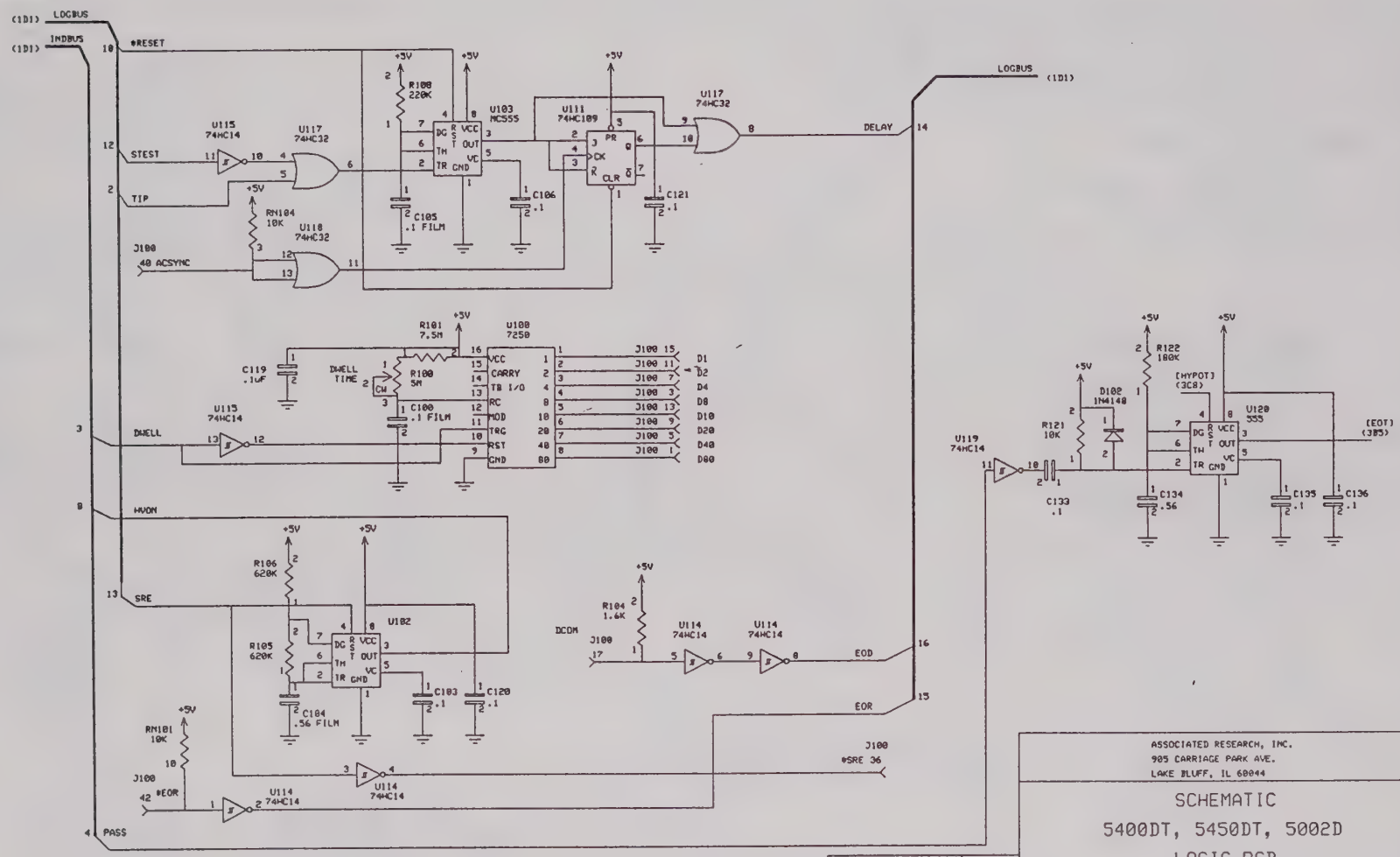
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC
5400DT, 5450DT, 5002D
LOGIC PCB

		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	9-1-93
APPROVED		9-8-93

SIZE	DRAWING NO.	REV.
B	S05002D-05	-

SCALE NONE | FILE: 37250.FSH | SHEET 3 OF 4



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LAKE BLUFF, IL 60044

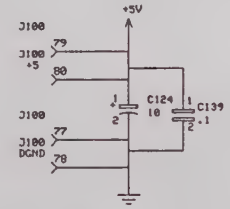
SCHEMATIC
5400DT, 5450DT, 5002D
LOGIC PCB

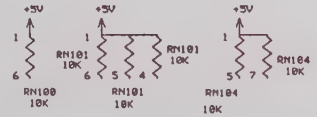
		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	9-1-93
APPROVED	[illegible]	7-8-93

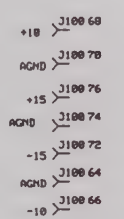
SIZE	DRAWING NO.	REV.
B	S05002D-05	-

SCALE NONE | FILE: 37250.FSH | SHEET 2 OF 4

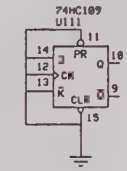
REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	COPIED SCHEMATIC 5400DT-05 REV.F AND REVISED FOR 05002D-05. ADDED U120-122, C133, C135-140, D102, R121-123, RN105, S100; DELETED U109, C109, NOTE 1 AND 2	-	06-15-93	RB	RB

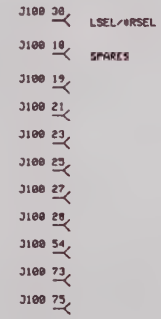


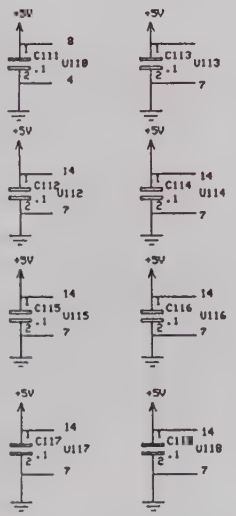




SPARE GATES







LAST USED REF DES	NOT USED
C 140	C 110
R 123	U 109
D 102	C 109
U 121	
RN 105	
J 100	
TP 111	
JU 102	
S 100	

NOTES:

3. ALL RESISTORS 1/4W 5% CARBON FILM UNLESS OTHERWISE STATED. VALUES IN OHMS. RESISTOR NETWORKS ARE 1/8 W 2%.
4. ALL CAPACITORS CERAMIC MONO UNLESS OTHERWISE NOTED. VALUES IN uF.
5. SWITCH CONFIGURATION SHOWN IN TABLE BELOW.

	HYAMP	HYPOT
S100-1 TO -5	ON	OFF
S100-6 TO -8	OFF	ON

6. BRACKETED SIGNAL NAMES [ ] REFERENCE 5002D, OTHERS ARE COMMON TO ALL MODELS OR 54XXDT ONLY.

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC
5400DT, 5450DT, 5002D
LOGIC PCB

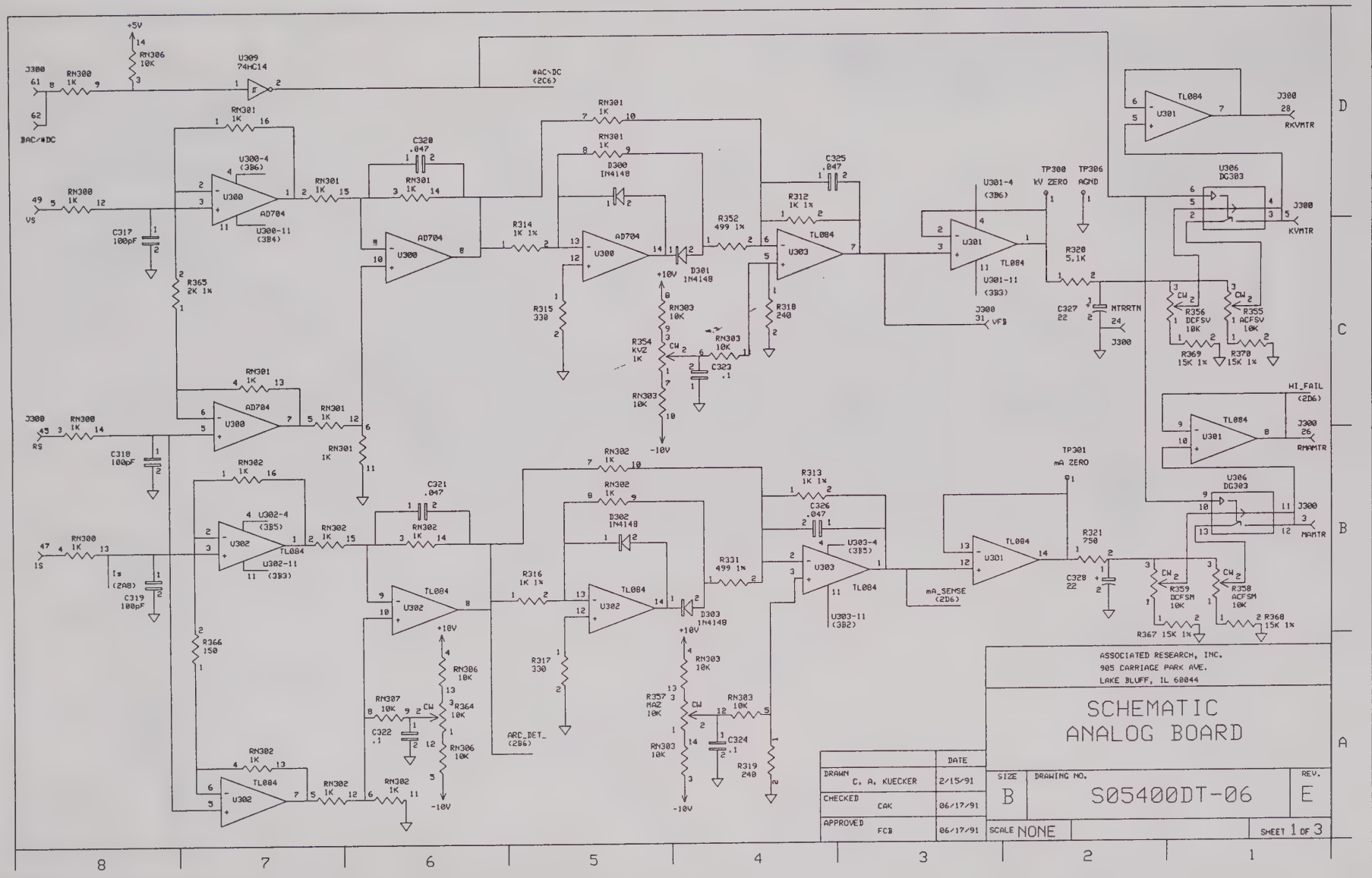
		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	9-1-93
APPROVED		9-8-93

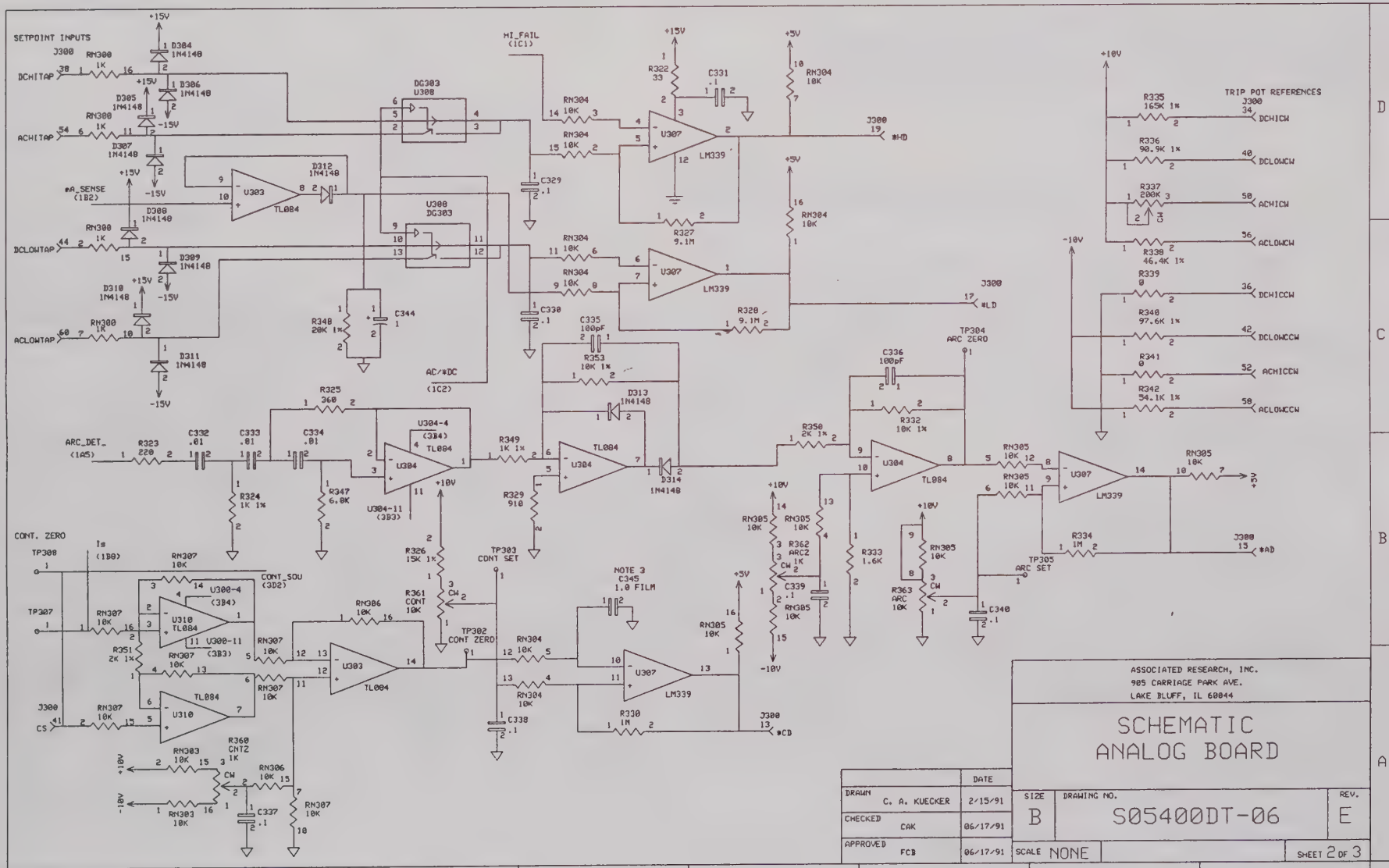
SIZE	DRAWING NO.	REV.
B	S05002D-05	-

SCALE NONE | FILE: 37250.FSH | SHEET 4 OF 4

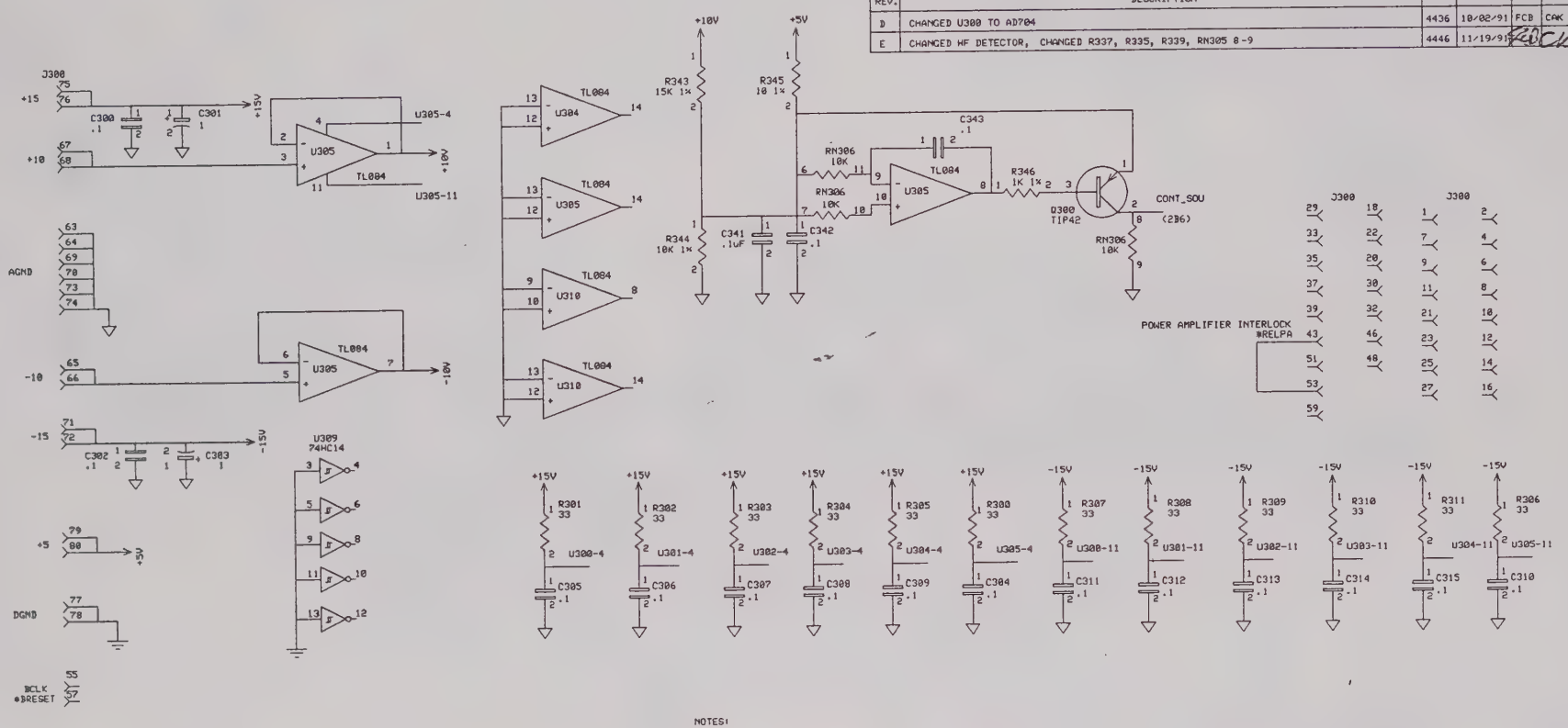
8 7 6 5 4 3 2 1

D C B A


+5V
RN306 10K
U309 74HC14
J300 61
RN300 1K
62
*AC>DC (2C6)
RN301 1K
U300-4 (3B6)
U300
AD704
U300-11 (3B4)
C320 .047
RN301 1K
D300 IN4148
RN301 1K
RN301 1K
C325 .047
R312 1K 1%
TL084
U303
U301-4 (3B6)
U301
TL084
U301-11 (3B3)
TP300 kV ZERO
TP306 AGND
U306 DG303
J300 28 RKVMTR
J300 KVMTR
J300 49 VS
C317 100pF
R365 2K 1%
R314 1K 1%
R352 499 1%
D301 IN4148
+10V
R315 330
RN303 10K
R354 KV2 1K
C323 .1
R318 240
J300 31 VFB
R320 5.1K
C327 22
MTRRTN
J300 24
R356 DCFSV 10K
R355 ACFSV 10K
R369 15K 1%
R370 15K 1%
-10V
WI_FAIL (2D6)
J300 26 RMAMTR
J300 49 RS
C318 100pF
RN302 1K
C321 .047
RN302 1K
D302 IN4148
R313 1K 1%
C326 .047
U303-4 (3B5)
U303
TL084
U303-11 (3B2)
TP301 mA ZERO
U306 DG303
J300 3 MAMTR
J300 47 IS
I$ (2A8)
C319 100pF
U302
TL084
U302-11 (3B3)
R316 1K 1%
R331 499 1%
D303 IN4148
R321 750
C328 22
mA_SENSE (2D6)
R359 DCFSM 10K
R358 ACFSM 10K
R367 15K 1%
R368 15K 1%
R366 150
RN306 10K
RN307 10K
R364 10K
C322 .1
ARC_DET_ (2B6)
R317 330
R357 MAZ 10K
RN303 10K
C324 .1
R319 240
-10V
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044
SCHEMATIC
ANALOG BOARD
DRAWN C. A. KUECKER 2/15/91
CHECKED CAK 06/17/91
APPROVED FCB 06/17/91
SIZE B
DRAWING NO. S05400DT-06
REV. E
SCALE NONE
SHEET 1 OF 3
8 7 6 5 4 3 2 1
D C B A


SETPOINT INPUTS
J300
DCHITAP
ACHITAP
DCLOWTAP
ACLOWTAP
RN300 1K
D384 1N4148
D385 1N4148
D386 1N4148
D307 1N4148
D308 1N4148
D309 1N4148
D310 1N4148
D311 1N4148
+15V
-15V
DG303 U308
U303 TL084
D312 1N4148
*A_SENSE (1B2)
C344 1
R348 20K 1%
AC/*DC (1C2)
HI_FAIL (1C1)
R322 33
C331 .1
RN304 10K
U307 LM339
R327 9.1M
R328 9.1M
C329 .1
C330 .1
C335 100pF
R353 10K 1%
D313 1N4148
D314 1N4148
+5V
J300 19 *HD
J300 17 *LD
TRIP POT REFERENCES
R335 165K 1%
R336 90.9K 1%
R337 200K
R338 46.4K 1%
R339 0
R340 97.6K 1%
R341 0
R342 34.1K 1%
DCHICW
DCLOWCW
ACHICW
ACLOWCW
DCHICCW
DCLOWCCW
ACHICCW
ACLOWCCW
+10V
-10V
TP304 ARC ZERO
C336 100pF
R332 10K 1%
R350 2K 1%
U304 TL084
U304-4 (3B4)
U304-11 (3B3)
ARC_DET_ (1A5)
R323 220
C332 .01
C333 .01
C334 .01
R325 360
R324 1K 1%
R347 6.8K
R349 1K 1%
R329 910
RN305 10K
R362 ARC2 1K
C339 .1
R333 1.6K
R363 ARC 10K
C340 .1
TP305 ARC SET
R334 1M
J300 15 *AD
CONT. ZERO
TP308
Is (1B0)
RN307 10K
CONT_SOU (3D2)
U300-4 (3B4)
U300-11 (3B3)
U310 TL084
TP307
R351 2K 1%
U303 TL084
RN306 10K
R361 CONT 10K
TP303 CONT SET
TP302 CONT ZERO
NOTE 3
C345 1.0 FILM
RN304 10K
U307 LM339
R330 1M
J300 13 *CD
C338 .1
J300 CS 41
R360 CNT2 1K
RN303 10K
RN306 10K
C337 .1
RN307 10K
R326 15K 1%
CW
CCW
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044
SCHEMATIC
ANALOG BOARD
DRAWN C. A. KUECKER 2/15/91
CHECKED CAK 06/17/91
APPROVED FCB 06/17/91
SIZE B
DRAWING NO. S05400DT-06
REV. E
SCALE NONE
SHEET 2 OF 3
8 7 6 5 4 3 2 1
D C B A

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
D	CHANGED U300 TO AD704	4436	10/02/91	FCB	CAK
E	CHANGED HF DETECTOR, CHANGED R337, R335, R339, RN305 8-9	4446	11/19/91	FCB	CAK



NOTES:

1. ALL RESISTORS ARE 1/4W 5% FILM TYPE UNLESS NOTED.
2. ALL CAPACITORS IN uF UNLESS NOTED.
3. PART MOUNTED ON SOLDER SIDE OF PCB.

REFERENCE DESIGNATORS

LAST USED	NOT USED
C 345	NONE
D 314	
Q 300	
R 370	
RN 307	
TP 308	
U 310	

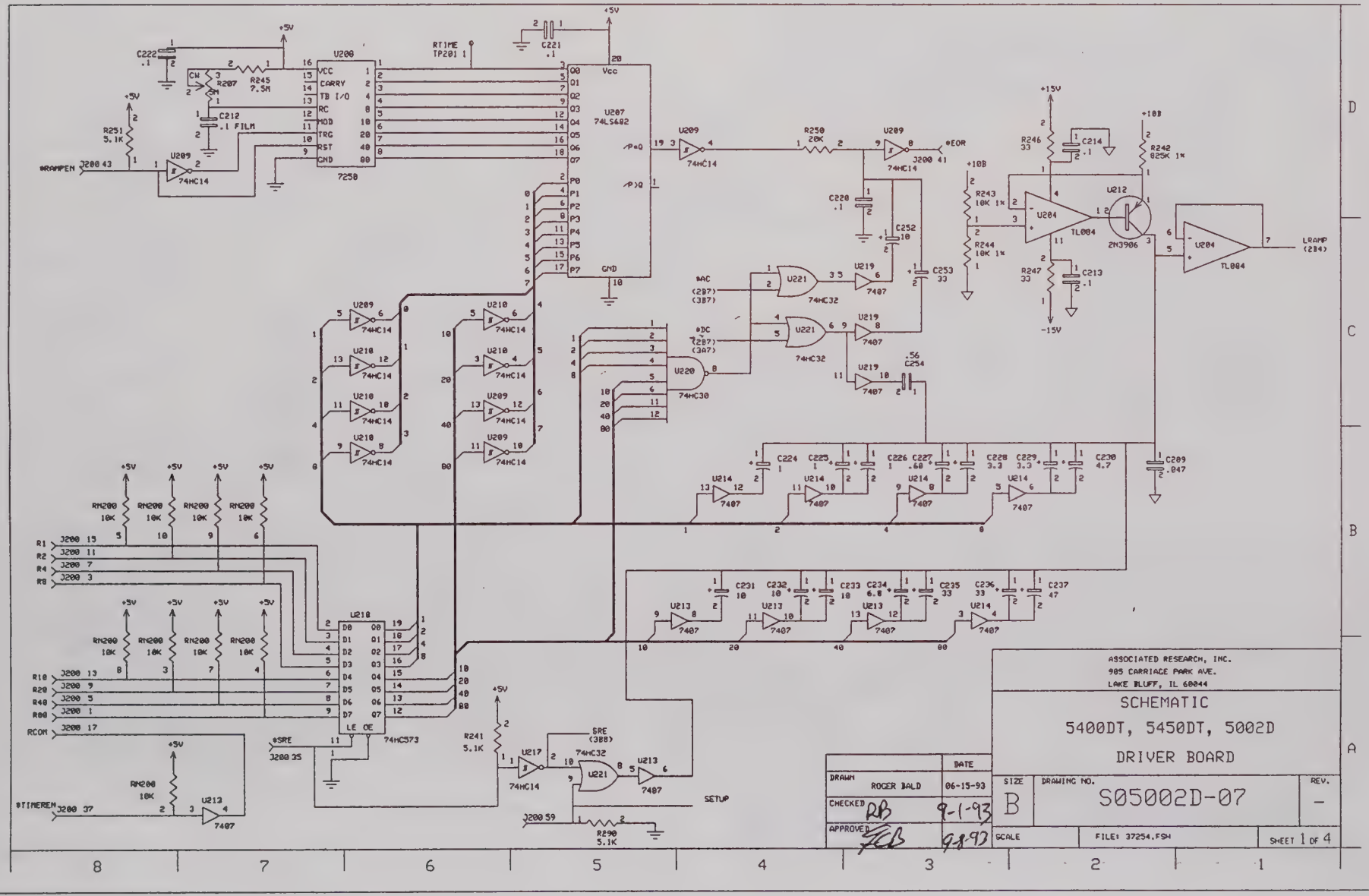
		DATE
DRAWN	C. A. KUECKER	2/15/91
CHECKED	CAK	06/17/91
APPROVED	FCB	06/17/91

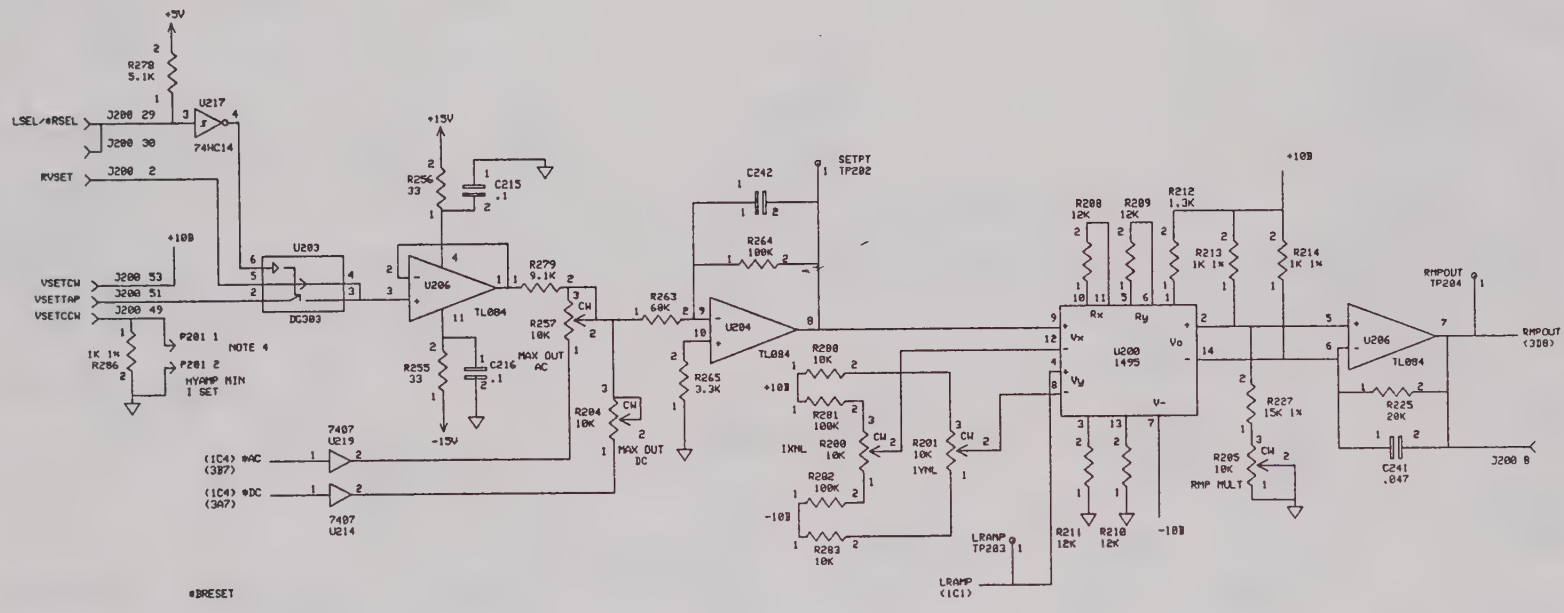
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC ANALOG BOARD

SIZE	DRAWING NO.	REV.
B	S05400DT-06	E

SCALE NONE SHEET 3 OF 3


ASSOCIATED RESEARCH, INC.
985 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044
SCHEMATIC
5400DT, 5450DT, 5002D
DRIVER BOARD
DRAWN ROGER BALD 06-15-93
CHECKED RB 9-1-93
APPROVED 9-8-93
SIZE B
DRAWING NO. S05002D-07
REV. -
SCALE
FILE: 37254.FSH
SHEET 1 OF 4

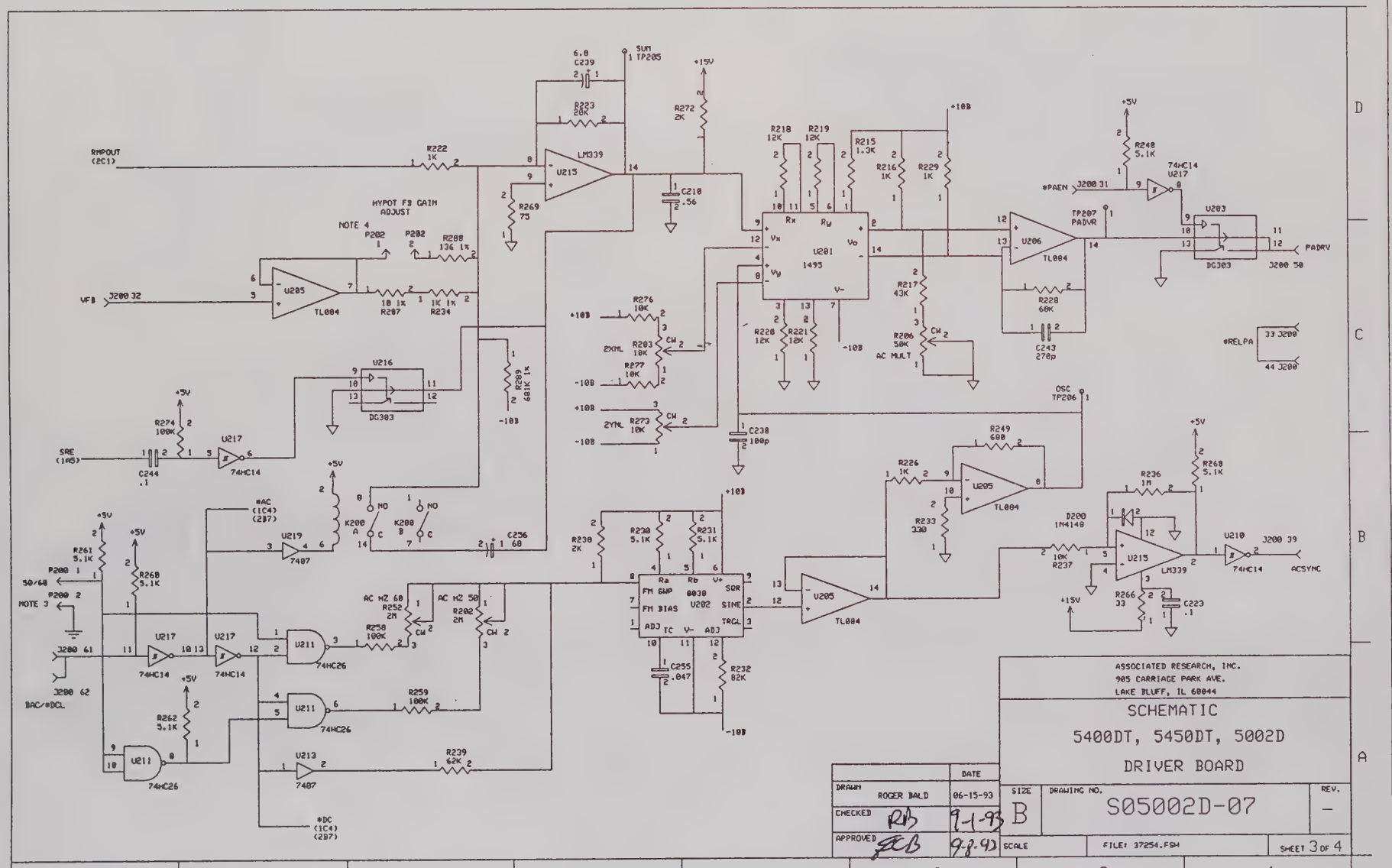


	DATE	
DRAWN ROGER BALD	06-15-93	
CHECKED	9-1-93	
APPROVED	9-8-93	

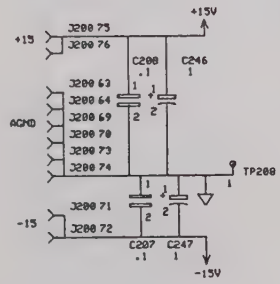
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

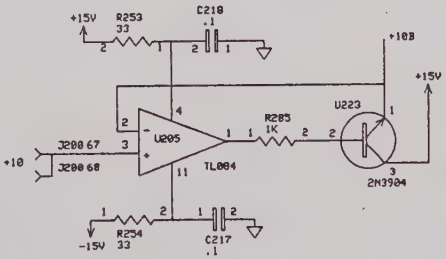
SCHEMATIC
5400DT, 5450DT, 5002D
DRIVER BOARD

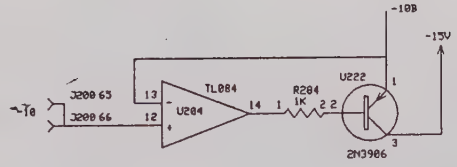
SIZE	DRAWING NO.	REV.
B	S05002D-07	-
SCALE	FILE: 37254.FSH	SHEET 2 OF 4


RMPOUT (2C1)
SUM TP205
+15V
LM339
U215
R222 1K
R272 2K
C239 6.8
R223 20K
R269 75
C210 .56
HYPOT FB GAIN ADJUST
NOTE 4
P202
R288 136 1%
VFB J200 32
U205 TL084
R287 10 1%
R234 1K 1%
R289 681K 1%
U216 DG303
SRE (1A5)
C244 .1
R274 100K
U217 74HC14
K200 A
K200 B
NO
C
U219 7407
*AC (1C4) (2B7)
C236 68
R261 5.1K
R268 5.1K
P200 1
P200 2
50/60
NOTE 3
J200 61
J200 62
BAC/*DCL
U211 74HC26
R252 2M
R202 2M
AC HZ 60
AC HZ 50
R258 100K
R259 100K
R262 5.1K
R239 62K
*DC (1C4) (2B7)
R218 12K
R219 12K
R215 1.3K
R216 1K
R229 1K
R217 43K
R206 50K AC MULT
R220 12K
R221 12K
U201 1493
Rx
Ry
Vx
Vy
Vo
V-
R276 10K
R203 10K 2XNL
R277 10K
R273 10K 2YNL
C238 100p
R230 2K
R231 5.1K
R232 82K
C255 .047
U202 8038
FM GNP
FM BIAS
ADJ
SQR
SINE
TRGL
TC
R226 1K
R249 600
R233 330
U205 TL084
D200 1N4148
R236 1M
R237 10K
U215 LM339
R266 33
C223 .1
U210 74HC14
J200 39
ACSYNC
OSC TP206
R248 5.1K
*PAEN J200 31
U217 74HC14
TP207 PADVR
U206 TL084
R228 68K
C243 270p
U203 DG303
PADRV J200 50
*RELPA
33 J200
44 J200
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044
SCHEMATIC
5400DT, 5450DT, 5002D
DRIVER BOARD
DRAWN ROGER BALD 06-15-93
CHECKED 9-1-93
APPROVED 9-8-93
SIZE B
DRAWING NO. S05002D-07
REV. -
SCALE
FILE: 37254.FSH
SHEET 3 OF 4

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	COPIED S054DDT-07 REV H AND ADDED P201, 202 AND R286-298 C256 WAS 6.8, C239 WAS .001	-	06-15-93	RB	RB

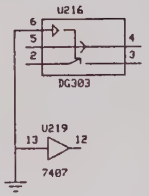




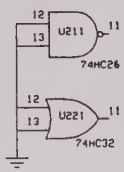


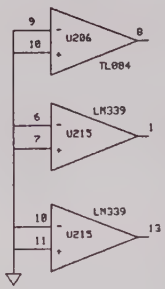
SPARE CONNECTOR PINS

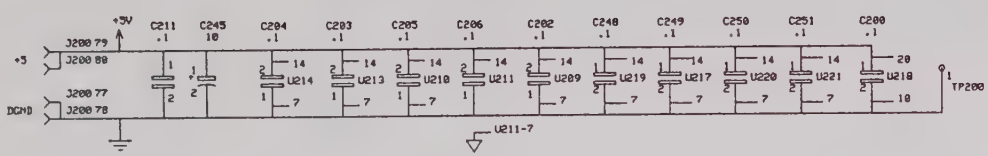
J200 4	J200 26	J200 60
J200 6	J200 28	J200 19
	J200 34	J200 21
J200 10	J200 36	J200 23
J200 12	J200 38	J200 25
J200 14	J200 40	J200 27
J200 16	J200 42	J200 45
J200 18	J200 46	J200 47
J200 20	J200 48	
J200 22	J200 52	
J200 24	J200 54	



SPARE GATES







NOTES:

1. UNLESS OTHERWISE NOTED ALL CAPACITOR VALUES ARE IN uF AND RESISTORS ARE 1/4W 5%. RESISTOR NETWORKS (RN) ARE 1/8W 2%.

3. P200 USED FOR OPTIONAL SWITCHING BETWEEN 50 AND 60 HZ. NOT A STANDARD COMPONENT IN BILL OF MATERIAL.

4. P201 AND P202 HAVE JUMPERS INSTALLED FOR MODELS 54XXDT.

REFERENCE DESIGNATORS

LAST USED	NOT USED
C256	R275
J200	
K200	
M202	
R298	
RN200	
TP208	
U223	

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC

5400DT, 5450DT, 5002D

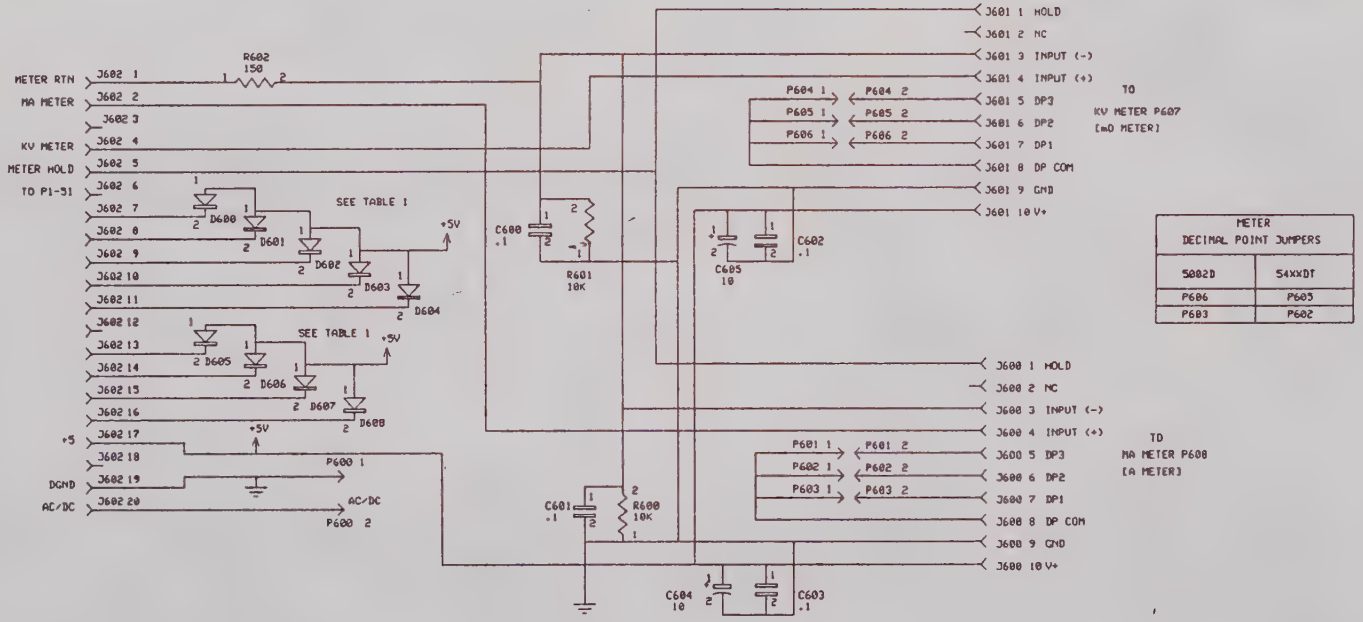
DRIVER BOARD

		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	6-1-93
APPROVED	ECB	6-8-93

SIZE: B | DRAWING NO.: S05002D-07 | REV.: -

SCALE | FILE: 37254.FSH | SHEET 4 OF 4

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
–	COPIED S0540DT-15 REV - AND MODIFIED	–	06-15-93	RB	RB



TO
MOTHER BOARD P7

TABLE 1		
LED	54XXDT	5002D
D600	READY	N/A
D601	RAMP	HYAMP/HYPOT
D602	DWELL	HYAMP
D603	PASS	SETUP
D604	HV	N/A
D605	HIGH	N/A
D606	LOW	TESTING
D607	ARC	PASS
D608	CONT.	FAIL

METER DECIMAL POINT JUMPERS	
5002D	54XXDT
P606	P605
P603	P602

REFERENCE DESIGNATORS

LAST USED	NOT USED
C603	C601
D608	R600
J602	R601
P606	
R602	

NOTES:

1. UNLESS OTHERWISE NOTED ALL CAPACITOR VALUES ARE IN uF AND RESISTORS ARE 1/4W, 5%.
2. BRACKETED SIGNAL NAMES [ ] REFERENCE 5002D, OTHERS ARE COMMON TO ALL MODELS OR 54XXDT ONLY.

		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	9-1-93
APPROVED	RB	9-8-93

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

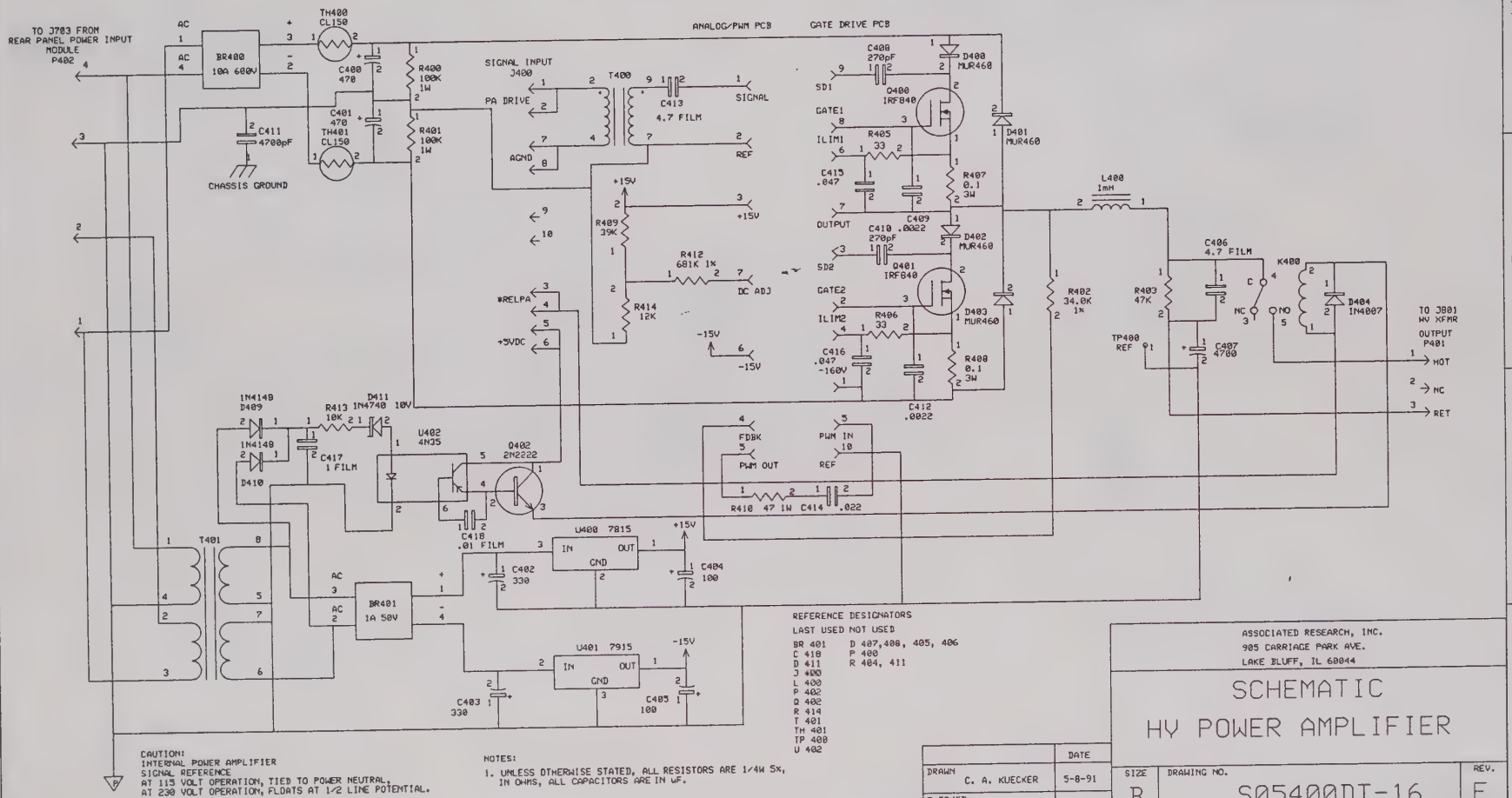
SCHEMATIC
5400DT, 5450DT, 5002D
FRONT PANEL
LED INDICATOR BOARD

SIZE	DRAWING NO.	REV.
B	S05002D-15	–
SCALE	FILE: 37251.FSH	SHEET 1 OF 1

8 7 6 5 4 3 2 1

D C B A

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
D	CORRECTED NUMBERING ON P402, VALUE OF C407 WAS 3900, SEE ECO FOR OTHER CHANGES	4464	03/02/92	FCB	CAK
E	CHANGED R400, R401 TO 100K 1W	4491	08/07/92	FCB	CAK



REFERENCE DESIGNATORS

LAST USED NOT USED

BR 401	D 407,408, 405, 406
C 418	P 400
D 411	R 404, 411
J 400	
L 400	
P 402	
Q 402	
R 414	
T 401	
TP 400	
U 402	

CAUTION!
INTERNAL POWER AMPLIFIER
SIGNAL REFERENCE
AT 115 VOLT OPERATION, TIED TO POWER NEUTRAL.
AT 230 VOLT OPERATION, FLOATS AT 1/2 LINE POTENTIAL.

NOTES:

1. UNLESS OTHERWISE STATED, ALL RESISTORS ARE 1/4W 5%, IN OHMS, ALL CAPACITORS ARE IN uF.

	DATE
DRAWN C. A. KUECKER	5-8-91
CHECKED FCB	6/17/91
APPROVED CAK	6/17/91

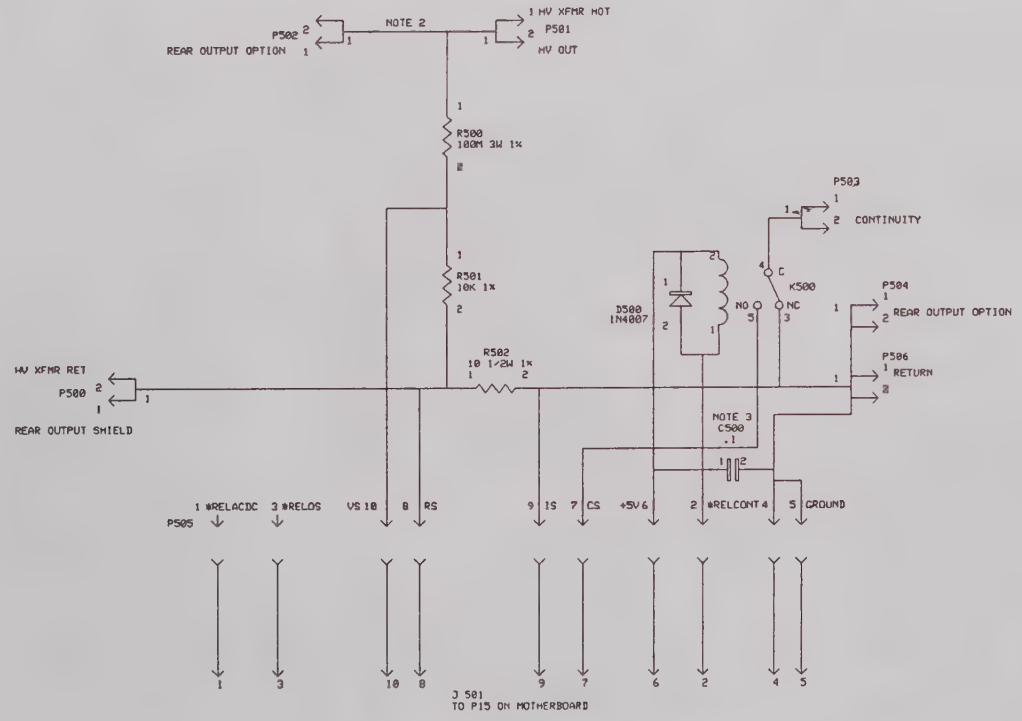
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC
HV POWER AMPLIFIER

SIZE	DRAWING NO.	REV.
B	S05400DT-16	E

SCALE NONE | FILE: 36736D.SCH | SHEET 1 OF 1

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
A	FIRST PRODUCTION PC BOARDS	-	06/17/91	FCB	CAK
B	ADDED C500	4421	07/08/91		



NOTES:

1. UNLESS OTHERWISE NOTED, ALL RESISTORS ARE 1/4W 5%, IN OHMS, ALL CAPACITORS IN uF.
2. ALL HV TRACES TO BE COATED WITH CORONA DOPE PER ASSEMBLY DWG.
3. PART MOUNTED ON SOLDER SIDE OF PCB.

REFERENCE DESIGNATORS:

LAST USED NOT USED

C 500
D 500
J 501
K 500
P 503
R 502

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

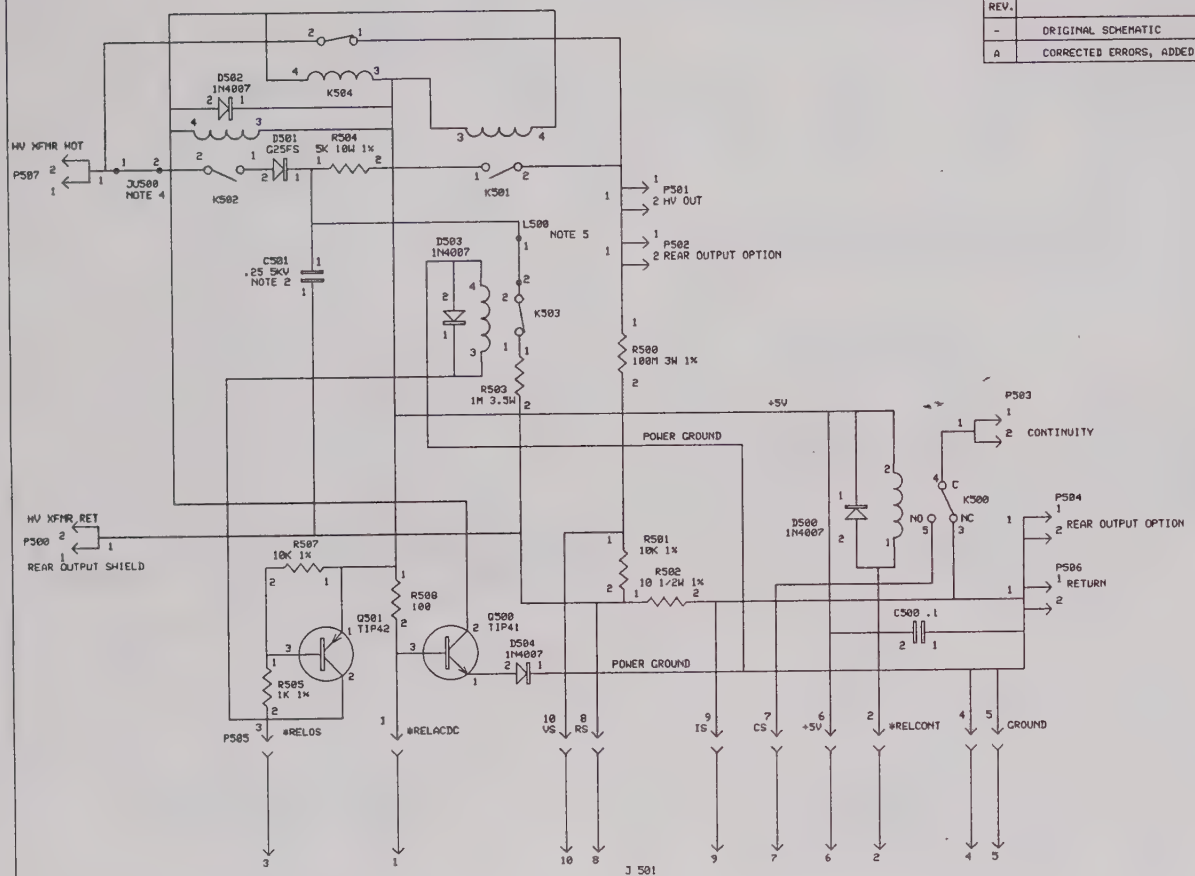
5400DT HV PCB SCHEMATIC

		DATE
DRAWN	C. KUECKER	01/31/91
CHECKED	CAK	06/18/91
APPROVED	FCB	06/18/91

SIZE: B | DRAWING NO.: S05400DT-19 | REV.: B

SCALE: NONE | SHEET 1 OF 1

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	ORIGINAL SCHEMATIC	-	06-06-91	CAK	FCB
A	CORRECTED ERRORS, ADDED L500 PADS	4476	05/18/92	CAK	FCB



NOTES:

1. UNLESS OTHERWISE NOTED, ALL RESISTORS ARE 1/4W 5%, IN OHMS, ALL CAPACITORS IN uF.
2. C 501 IS MOUNTED ON THE SOLDER SIDE OF THE PC BOARD.
3. ALL SOLDER JOINTS TO BE FREE OF SHARP POINTS.
4. JU 500 IS #18 AWG HV INSULATED WIRE.
5. L 500 IS #20 AWG TINNED WIRE.

REFERENCE DESIGNATORS:

LAST USED	NOT USED
C 501	R 506
D 504	
J 501	
JU 500	
K 504	
L 500	
P 506	
Q 501	
R 508	

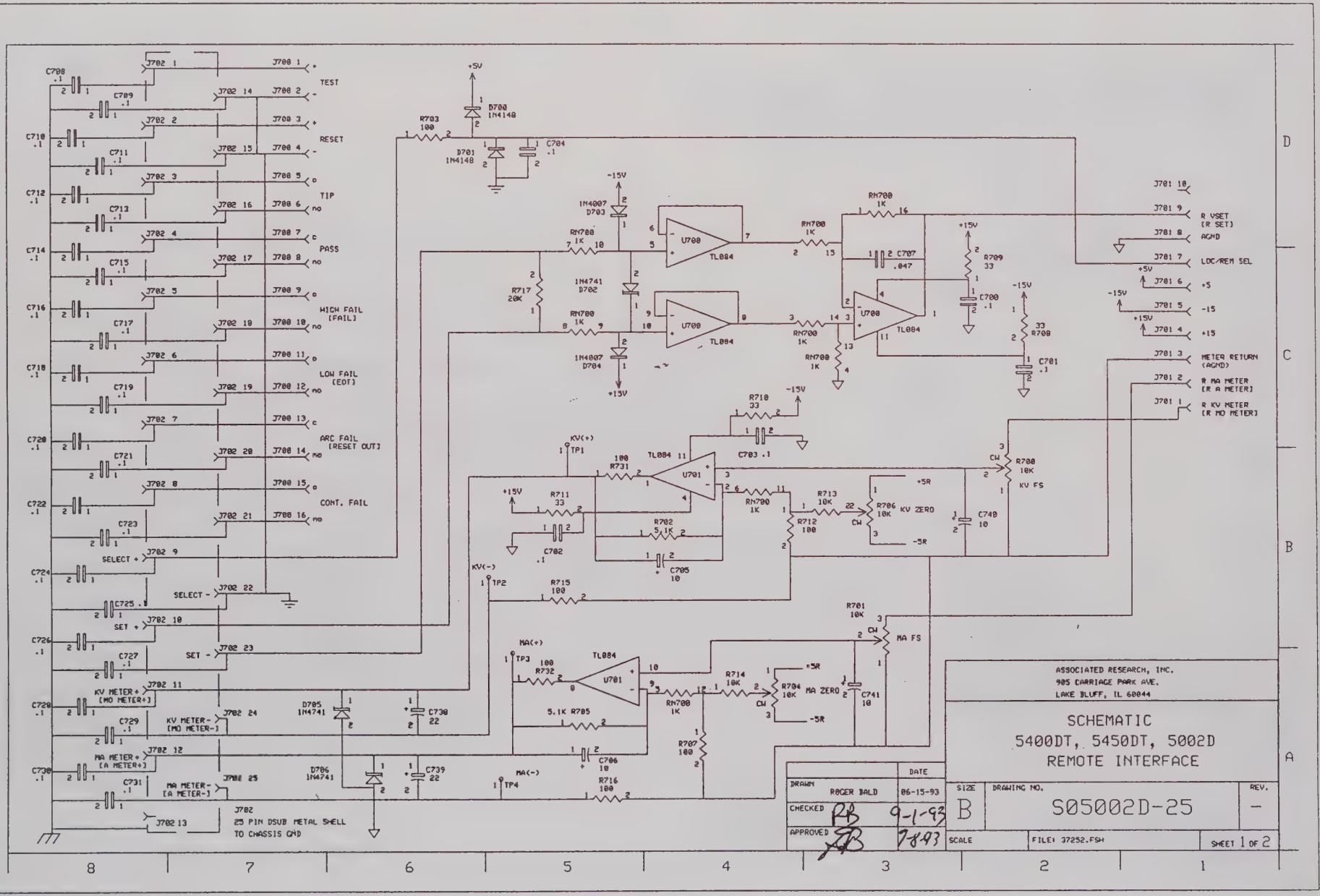
	DATE
DRAWN C. KUECKER	06/06/91
CHECKED CAK	08/08/91
APPROVED FCB	08/08/91

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

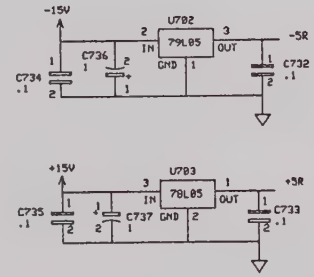
5450DT HV PCB SCHEMATIC

SIZE	DRAWING NO.	REV.
B	S05450DT-19	A

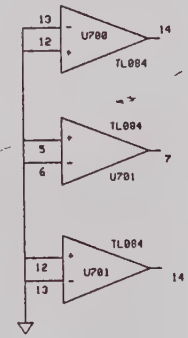
SCALE NONE | FILE: 36955A.SCH | SHEET 1 OF 1


J702 1
J700 1
TEST
J702 14
J700 2
J702 2
J700 3
RESET
J702 15
J700 4
J702 3
J700 5
TIP
J702 16
J700 6
J702 4
J700 7
PASS
J702 17
J700 8
J702 5
J700 9
HIGH FAIL (FAIL)
J702 18
J700 10
J702 6
J700 11
LOW FAIL (EOT)
J702 19
J700 12
J702 7
J700 13
ARC FAIL (RESET OUT)
J702 20
J700 14
J702 8
J700 15
CONT. FAIL
J702 21
J700 16
J702 9
SELECT +
J702 22
SELECT -
J702 10
SET +
J702 23
SET -
J702 11
KV METER+ (MO METER+)
J702 24
KV METER- (MO METER-)
J702 12
MA METER+ (A METER+)
J702 25
MA METER- (A METER-)
J702 13
J702 25 PIN DSUB METAL SHELL TO CHASSIS GND
+5V
D700 1N4148
D701 1N4148
R703 100
C704 .1
-15V
+15V
U700 TL084
U701 TL084
R700 1K
R709 33
R708 33
R717 20K
C707 .047
C700 .1
C701 .1
R710 33
C703 .1
R711 33
C702 .1
R731 100
R702 5.1K
C705 10
R713 10K
R706 10K KV ZERO
R712 100
C740 10
R700 10K KV FS
+5R
-5R
KV(+)
KV(-)
TP1
TP2
R715 100
R701 10K MA FS
MA(+)
MA(-)
TP3
TP4
R732 100
5.1K R705
C706 10
R714 10K
R704 10K MA ZERO
C741 10
R707 100
R716 100
D705 1N4741
D706 1N4741
C738 22
C739 22
J701 10
J701 9
R VSET (R SET)
J701 8
AGND
J701 7
LOC/REM SEL
J701 6
+5
J701 5
-15
J701 4
+15
J701 3
METER RETURN (AGND)
J701 2
R MA METER (R A METER)
J701 1
R KV METER (R MO METER)
ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044
SCHEMATIC
5400DT, 5450DT, 5002D
REMOTE INTERFACE
DRAWN ROGER BALD 06-15-93
CHECKED RB 9-1-93
APPROVED 7-8-93
SIZE B
DRAWING NO. S05002D-25
REV. -
SCALE
FILE: 37252.FSH
SHEET 1 OF 2
8 7 6 5 4 3 2 1
D C B A

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	COPIED 5400DT-24 REV C SCHEMATIC FOR 5002D-25 SCHEMATIC AND ADDED R731,732 D705,706	-	06-15-93	RB	RB



SPARE GATES



SPARE CONNECTOR PINS

J700 26 J700 21
J700 25 J700 20
J700 24 J700 19
J700 23 J700 18
J700 22 J700 17

REFERERENCE DESIGNATORS

LAST USED	NOT USED
C741	R710-730
D706	
J702	
R732	
RN700	
U703	

NOTES:
1. UNLESS OTHERWISE STATED ALL CAPACITOR VALUES ARE IN uF, AND RESISTORS ARE 1/4W 5%.
2. BRACKETED SIGNAL NAMES ( ) REFERENCE 5002D, OTHERS ARE COMMON TO ALL MODELS OR 54XXDT ONLY.

		DATE
DRAWN	ROGER BALD	06-15-93
CHECKED	RB	9-1-93
APPROVED	RCB	9-8-93

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

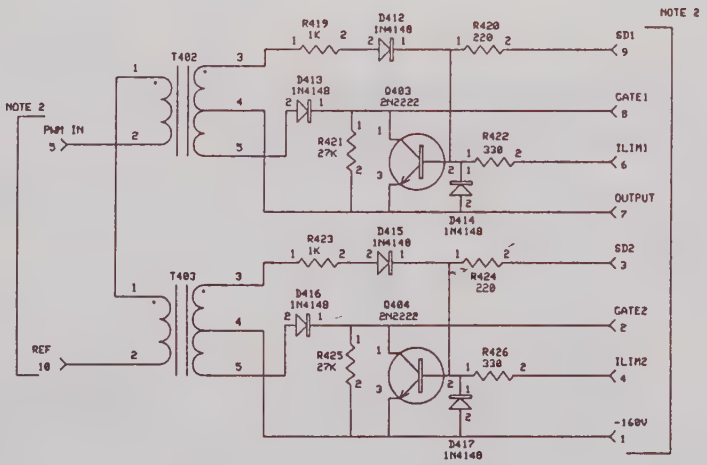
SCHEMATIC
5400DT, 5450DT, 5002D
REMOTE INTERFACE

SIZE	DRAWING NO.	REV.
B	S05002D-25	-
SCALE	FILE: 37252.FSH	SHEET 2 OF 2

8 7 6 5 4 3 2 1

D C B A

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	PRE-PRODUCTION PC BOARDS	-			
A	FIRST PRODUCTION PC BOARDS	-	06-05-91		



REFERENCE DESIGNATORS:

LAST USED	NOT USED
D 417	
Q 404	
R 426	
T 403	

NOTES:

1. UNLESS OTHERWISE NOTED, ALL RESISTORS ARE 1/4W 5%, IN OHMS, ALL CAPACITORS ARE IN uF.
2. TO HV POWER AMPLIFIER. SEE SCHEMATIC S05400DT-16.

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

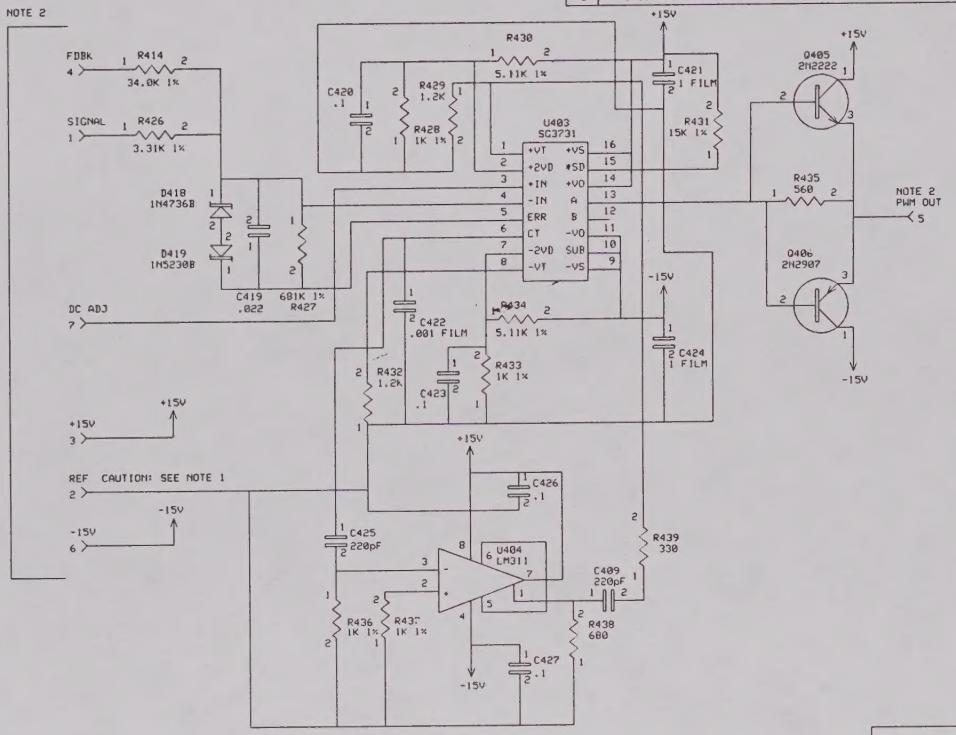
SCHEMATIC
GATE DRIVE ASSY

		DATE
DRAWN	C. A. KUECKER	5-8-91
CHECKED		5/9/91
APPROVED		5/9/91

SIZE	DRAWING NO.	REV.
B	S05400DT-31	A

SCALE NONE SHEET 1 OF 1

REVISION					
REV.	DESCRIPTION	ECO	DATE	APR.	CHK.
-	PRE-PRODUCTION PC BOARDS	-			
A	FIRST PRODUCTION PC BOARDS	-	06-05-91	-	-
B	C419 WAS .1 FILM	4528	09-03-93	FCB	RB



NOTES:

1) INTERNAL POWER AMPLIFIER SIGNAL REFERENCE
   AT 115 VOLT OPERATION, TIED TO POWER NEUTRAL.
   AT 230 VOLT OPERATION, FLOATS AT 1/2 LINE POTENTIAL.
2) TO HV POWER AMPLIFIER. SEE SCHEMATIC S05400DT-16.
3) UNLESS OTHERWISE STATED, ALL RESISTORS ARE 1/4W 5%, ALL IN OHMS, CAPACITORS IN uF.

REFERENCE DESIGNATORS:

LAST USED	NOT USED
C 429	C 428
D 419	R415-426
Q 406	
R 439	
U 404	

NOTE: R419-426 USED ON S05400DT-31 GATE DRIVE PCB

		DATE
DRAWN	C. A. KUECKER	5-8-91
CHECKED	CAK	06-17-91
APPROVED	FCB	06-17-91

ASSOCIATED RESEARCH, INC.
905 CARRIAGE PARK AVE.
LAKE BLUFF, IL 60044

SCHEMATIC
ANALOG / PWM ASSY

SIZE	DRAWING NO.	REV.
B	S05400DT-32	B

SCALE NONE | FILE: 36822B.FSH | SHEET 1 OF 1

8 7 6 5 4 3 2 1

D C B A

MP MASTER
MA30098